NEW SOUTH WALES.

DEPARTMENT OF MINES AND AGRICULTURE.

GEOLOGICAL SURVEY.

E. F. PITTMAN, A.R.S.M., Government Geologist.

MINERAL RESOURCES.

No. 5.

REPORT

ON THE

WYALONG GOLD-FIELD.

BY

J. A. WATT, M.A., B.Sc.,

GEOLOGICAL SURVEYOR.

1899.

SYDNEY: WILLIAM APPLEGATE GULLICK, GOVERNMENT PRINTER.

1899.

36587 A [1*s.* 6*d.*]

Geological Survey Branch,
Department of Mines and Agriculture,

Sir, 21 January, 1899.

I have the honor to transmit for publication a report (accompanied by a geological map) on the Wyalong Gold-field, by Mr. J. A. Watt, Geological Surveyor.

The Wyalong Gold-field was discovered in 1893, and it has since been developed so vigorously that it is, at the present time, the most productive field in the Colony. The characteristic lenticular lodes in which the gold was first found near the surface, and which occurred in decomposed granite, have been proved to extend downwards into the undecomposed rock, and to preserve their general character, as well as their productiveness, to considerable depths. The permanence of the field, therefore, appears to be assured.

With regard to the question of alluvial deposits, it is, I think, premature to assert that such deposits do not exist in the neighbourhood, though it is a fact that they have not yet been discovered. The difficulties in the way of finding alluvial leads in such flat country as that surrounding Wyalong are very great, seeing that the surface presents no features that would serve as guides to prospectors. The same difficulties exist in portions of Western Australia, where alluvial gold was not discovered for a considerable time after the lodes had been proved, and where, I feel convinced, many more alluvial leads will yet be found.

There can be no doubt that very extensive denudation of the Wyalong District took place in Tertiary times; the present configuration of the surface supplies proof of this, and further evidence is afforded by the existence of a Tertiary basin, at least 900 feet thick, which exists near the junction of the Murray and Darling Rivers. The average annual rainfall of Wyalong is 13·63 inches, but there is reason for supposing that in Tertiary times the rainfall in Australia was very much greater than it is at the present day. The altitude of Wyalong is nearly 800 feet above sea-level, and I think therefore that there must have been, during the Tertiary period, well-defined channels through which the drainage of this elevated district found its way to the sea, or to the basin or lake just alluded to, the bottom of which is at least 1,300 feet below the present level of Wyalong. In such drainage channels the gold derived from the denudation of the auriferous reefs must have been concentrated, and I venture to think, therefore, that alluvial leads will yet be discovered in this district.

I have the honor to be, Sir,

Your obedient Servant,

EDWARD F. PITTMAN,
Government Geologist.

The Under Secretary for Mines.

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Report on the Wyalong Gold-field.

By J. ALEX. WATT, Geological Surveyor.

4th January, 1899.

PART I.

1. The Discovery of Gold at Wyalong.

The Wyalong Gold-field has already proved itself so rich and extensive that one naturally feels surprised that it remained so long undiscovered. An examination of the Gold-field, however, at once furnishes us with adequate reasons to account for this delay in its discovery. Among the most important we may mention (*a*) the absence of alluvial-gold deposits; (*b*) the level nature of the ground, and its almost universal covering of red soil; (*c*) the absence of natural supplies of surface water; (*d*) the sparsely-settled condition of the surrounding country; and (*e*) the extremely fine condition of the gold.

The influence of (*a*) will be understood when we remember that alluvial deposits, sometimes extremely shallow, have been found on nearly all the large gold-fields; that these were first found and worked, and that it was only later that the gold was traced to the reefs. The result of (*b*) is that there are very few outcrops of reefs, as these are nearly all concealed by the superficial deposits.

The absence of natural supplies of surface water, and the sparsely-settled condition of this part of the Colony, must have proved almost insuperable obstacles to the prospector.

The influence of (*e*) is evident, for in much of the stone, even where it is rich and the gold is in the free state, it is in such a fine state of division that it can scarcely be detected with the naked eye.

The foregoing facts, as well as explaining the delay in the discovery of this gold-field, show also the amount of credit that is due to the Neeld family for their discovery.

It was not to prospect for gold, however, that Mr. Neeld left Victoria and came over to this Colony; but having made several unsuccessful attempts to obtain a sufficiently large area for selection in the neighbouring colony, he made up his mind to take up land for a similar purpose in this Colony.

With this end in view, one of the sons, then at Hiawatha, near Wyalong, was commissioned to look out for land suitable for settlement in that neighbourhood. As a result, a somewhat small area was obtained at Wyalong, and

the family came over and settled down on it. The whole of this selection was afterwards resumed, for as mining developments advanced it was found that a large part of the auriferous area was contained within the boundaries of the selection.

Mr. Neeld, who has had considerable experience on the Bendigo, Ballarat, and other Victorian gold-fields, seems to have been impressed by the auriferous indications immediately on his arrival on the 2nd August, 1893. The ironstone nodules and loose fragments of quartz had attracted his attention. No time was lost in commencing prospecting operations, for on the morning after his arrival he tried several dishes of the surface material, but did not succeed in finding gold. Still he persevered, and one morning, about a month after his arrival, the first gold was found. This was in a loose piece of quartz. Several other pieces were found, taken to the camp, crushed, and washed, when a nice trail of fine gold was found in the dish.

The site of this first discovery of gold at Wyalong was on what was afterwards known as the Pioneer Claim. (*See* map.) A fortnight elapsed from the date of this discovery before systematic prospecting operations were started.

As there were practically no outcrops, the method consisted in examining loose fragments of quartz and washing dishes of the surface rubble. In this way the gold was traced gradually up the slight inclines, until no further prospects could be obtained. Near this spot narrow trenches were dug through the soil and rubble into the decomposed granite, until the reef was located.

While Mr. Neeld was prospecting the first discovery, one of his sons found gold-bearing stones just outside the selection, and about ten chains to the east of the former site. The reef from which these stones were derived was soon located. This site was afterwards known as the Dead Rabbit Claim, and later still as the Easter Gift. Later developments proved these two discoveries to be on the same line of reef.

In estimating the difficulties surrounding the prospecting of this part of the gold-field, it must be noted that these early discoveries were made in the midst of thick mallee scrub.

The third discovery was made by Mr. Harry Neeld, who picked up auriferous stone just within the mallee scrub, and on the site now known as Harry's Find. This is on Klink's line of reef, and adjoins Klink's Claim, which has paid large dividends. Harry's Find has remained in the possession of the Neeld family, and has yielded a large amount of payable stone. The next discovery was made on what is now known as the Red Flag Claim. Gold was also found near the site now occupied by the Currajong Mine, but no prospecting was done there. Up to this time shafts varying from a few feet up to fourteen feet deep had been sunk on the various finds.

The most important discovery was made at the end of October, when some of the sons, in going from their camp to the White Tank, found several pieces of gold-bearing stone on the surface of what afterwards became their Prospecting Claim. This site was vigorously prospected, and a shaft 30 feet in depth sunk on the reef.

Now that the field had been fairly well prospected by them they decided to peg out their claims and apply for them.

The pegging-out was done on the 16th December, 1893; first, the Prospecting Claim 960 feet by 400 feet, then Harry's Find as four men's ground; thirdly, the Pioneer Claim, also as four men's ground; fourthly, Christmas Gift as a prospecting claim, and lastly the Dead Rabbit.

On Monday, 18th December, Mr. Neeld went to Barmedman, reported his discovery, and put in his applications.

Ordinary applications were at first put in, but as the land on which most of the finds had been made formed part of Mr. Neeld's selection, it was necessary to exchange the original applications for applications for permits.

Men began to arrive on the night of 18th December, the day on which the discovery was reported, and by the end of January, 1894, there were about 500 men on the ground.

It was, however, not till March of the same year, when the results of the first parcels of ore crushed at the Barmedman Battery became known, that the big rush took place. By the end of that month about 10,000 people had arrived at Wyalong.

The importance of Mr. Neeld's discovery will be recognised when it is pointed out that in 1897 Wyalong produced more gold than any other mining division in the Colony. The production for that year was 34,370 oz., while Hillgrove, including Metz, which occupied second place, produced 31,886 oz. The total yield from the Wyalong Gold-field since its discovery at the close of 1893 up to the present cannot be less than 130,000 oz., worth more than half a million sterling.

2. History of the Development of Mining at Wyalong.

Ordinary quartz claims only were allowed in the early days of this gold-field. This arrangement gave very satisfactory results for a time, as it prevented the monopolisation of the ground by a few of the first comers, while it led to prospecting operations being vigorously carried on in all parts of the field by parties of working men.

The successful working of this arrangement was in no small measure due to the soft character of the ground, which over almost all parts of the field could be worked with pick and shovel alone down to a depth of at least 150 feet, thus making the sinking of shafts a very inexpensive matter. As a consequence of this many of the reefs have been profitably worked, which had the ground been hard would certainly have been abandoned.

No leases were granted until March, 1896, or more than two years after the discovery of the field. At first, however, the same conditions as to labour were enforced on the leases as on the claims. The object of this was to ensure that the miners already working on the claims should be retained on the leases, and its justification lay in the fact that the sinking was easy, and the leases were mostly still held by working miners.

When, however, the workings reached the hard country rock, and the mining expenses consequently increased, it was decided to allow the old leases to be surrendered and new leases with the ordinary labours conditions to be taken out.

As already mentioned, Mr. Neeld reported the discovery of gold at Wyalong in December, 1893, at which time a shaft 40 feet in depth had been sunk on his Prospecting Claim. There was exposed in this shaft a reef which varied from five or six inches in width at the surface to four feet, and the stone from it was worth from 1 oz. to 1½ oz. per ton.

In the early part of 1894 stone was raised from several parts of the field and sent to the battery at Barmedman for treatment. The results of these first parcels of stone were made known in March, 1894, and caused the big

rush. I quote from Mr. Slee's report* the results of these crushings, as they are historically interesting. They are as follows :—

Neeld and party		13	tons yielded	26	oz.	4	dwts.
Cassin	,,	12½	,,	9	,,	3	,,
Conway	,,	22	,,	103	,,	5	,,
Keith	,,	28¼	,,	67	,,	0	,,
Neeld	,, (No. 2)	17	,,	72	,,	16	,,
Perry	,,	17	,,	42	,,	18	,,
Frazer	,,	10½	,,	39	,,	6	,,
Gorman	,,	37	,,	77	,,	12	,,
Smith	,,	6	,,	8	,,	14	,,
McMahon	,,	4	,,	10	,,	0	,,
Lawry	,,	14¼	,,	14	,,	18	,,
Total		181½	tons.	471	oz.	16	dwts.

Thus 181½ tons of stone yielded 471 oz. 16 dwts. of gold, or at the rate of 2 oz. 12 dwts. per ton.

Experience has since shown that rich oxidised stone, as that treated at the Barmedman battery, cannot be satisfactorily treated by this process, and that where such material has been passed through a battery at Wyalong, there has been, almost without exception, a great loss of gold in the tailings. It is, therefore, necessary to point out that the results obtained from the first parcels of stone treated at Barmedman do not in all probability represent the true value of the stone, but that, at least, an ounce to the ton was left in the tailings.

At the end of 1894 the population of the two towns was 4,215. There were 300 claims at work, each consisting of four or eight men's ground. Of these, at least twenty-five were yielding more than payable returns.

During 1894, 6,358 tons of gold-bearing quarts were treated at Wyalong and Barmedman for a total yield of 9,649 oz., or at the rate of 1 oz. 10 dwts. per ton. This does not include the gold contained in the tailings, which, as their treatment later showed, were rich, and, if added, would make up the total contents of the stone treated that year to about 2 oz. per ton.

By the end of 1894 there were six crushing machines at Wyalong. These have since been reduced to four ; and two chlorination works were erected, when it became recognised that chlorination was the most suitable process for the treatment of the rich ores.

During 1895 the raising of stone was carried on vigorously, and 15,634 tons were treated for a total yield of 24,497 oz., or an average of 1 oz. 11 dwts. per ton. This return does not include the contents of small parcels sent to Sydney and elsewhere for treatment.

The mine that produced the largest yield during this year was the Currajong, which produced 1,000 tons of ore, yielding 2,620 oz. of gold. During the same year, 1,213 tons from the White Reef Mine gave 2,447 oz. ; 318 tons from the Welcome Stranger gave 1,782 oz., and 1,060 tons from the True Blue gave 1,426 oz. By the end of that year shafts ranging from 245 feet in depth downwards had been sunk on the various claims.

During 1896 there were 18,279 tons of stone treated for a total yield of 33,495 oz., or at the rate of 1 oz. 17 dwts. per ton. The deepest shaft at the end of that year was that on the Lighthouse Claim, which had been sunk to to a depth of 310 feet in solid granite. It was sunk to cut Klink's Reef, which, however, was cut at 230 feet from the surface, but not recognised as such at the time.

* Ann. Rept. Dept. Mines and Agric. N.S. Wales for 1894, p. 74.

The highest yield in 1896 was obtained from Bolte's Mine, now known as the Lucknow, viz., 2,506 oz., from 377 tons of stone, or at the rate of 6 oz. 13 dwts. per ton. From the New South Wales Mine 352 tons were treated for a yield of 2,338 oz.

Neeld's Chlorinations Works were started towards the end of 1896.

The production reached a maximum in 1897, being 34,370 oz. This was derived from three sources, viz., stone, "mullock," and tailings. "Mullock" is the name generally applied to the waste rock which is broken down when the reef is being taken out. In some of the Wyalong Mines, and especially in their upper or oxidised zones, the country rock bordering the reefs is much iron-stained, and often encloses thin veins or leaders of gold-bearing quartz. This is the so-called "mullock" that has been, and is even now being, put through the batteries. Its gold contents vary from a pennyweight or two to half an ounce per ton.

In 1897, 30,750 tons of stone were treated for a return of 33,900 oz., being an average yield of about 1 oz. 2 dwts. per ton, and 4,000 tons of "mullock" yielded 470 oz., or at the rate of nearly 2½ dwts. per ton. About 2,100 miners were employed on the field during the year, and the population was 4,200, or about the same as in 1896.

At the end of 1897 the deepest shaft was on the Lighthouse Claim; this shaft was 504 feet in depth, and is entirely in granite. The following were some of the highest yields obtained during that year:—Currajong Mine, 1,452 oz., from 1,200 tons; Klink's Mine, 1,877 oz., from 275 tons; Shamrock and Thistle Mine, 2,406 oz., from 492 tons; Lucknow Mine, 1,275 oz., from 324 tons; White Reef Mine, 1,264 oz., from 980 tons; and Perseverance Mine, 1,134 oz., from 418 tons.

During the past year, 1898, large quantities of stone and "mullock" have been treated at the different works, and large quantities of tailings at the cyanide works.

Up to the end of September there was treated at Gough's Battery 2,977 tons of stone, which yielded 1,877 oz. 14 dwts.; and 518 tons of "mullock" for 98 oz.; and at West's Battery, 2,438 tons of "mullock" for a return of 371 oz. 3 dwts. At Cox's Mill, up to 20th October, 1,688 tons of stone were treated for a return of 1,150 oz.

Since this report was written the total yield for 1898 has been estimated at 34,582 oz., being 212 oz. above that for 1897.

Developmental work is not being so vigorously carried on at the present time as one could wish. In too many of the mines it has been stopped when the vertical limits of the soft decomposed ground were reached. This is the case even with several of the mines that have yielded rich stone in the easily-worked ground, and have paid large sums in dividends. In many other cases, where the mines have only proved moderately payable, it has been impossible for the holders of the small claims to carry on expensive prospecting operations in the hard ground.

3. Previous References to the Wyalong Gold-field.

In May, 1894, a few months subsequent to its discovery, a geological examination was made of the Wyalong Gold-field by Mr. E. F. Pittman, Government Geologist.*

Two reports were furnished during the same year by the Chief Inspector of Mines.† In addition to the above, annual reports have been furnished by Mr. Warden Clarke for the years 1895–1898. (*See* Annual Reports on this Department for those years.)

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* Ann. Rept. Dept. Mines and Agric. N.S. Wales for 1894, pp. 105–108; and Records Geol. Survey N.S. Wales, IV, pt. 2, p. 107.

† Ann. Rept. Dept. Mines and Agric. N.S. Wales for 1894, pp. 24–25, also pp. 73–74.

PART II.

1. Physical Geography.

In and around Wyalong the surface of the ground is generally flat, with only a few isolated and widely-separated hills of very moderate height. The Government township of Wyalong stands partly on one of these low elevations, and a second is situated about half a mile to the N.E.

Other low rises occur at Pine Ridge and Pine Hill about 1½ miles S.S.E. of Wyalong.

In the area included in the map accompanying this report there are two main geological divisions; one is occupied by granite, and the other by highly altered sedimentary strata and intrusive hornblendic rocks.

The low hills are practically confined to the latter area, over which the rocks have not been so extensively decomposed as on the granite area. The granite over almost the whole of the gold-field has been decomposed to a mean depth of about 150 feet. The surface over this area is flat, or perhaps, more strictly speaking, is occupied by a flat, shallow depression, with an outlet in the south-easterly portion of the field.

The Wyalong Gold-field is situated within the drainage basin of the Lachlan River, and about eight miles from the water-parting which separates this basin from the adjoining one of the Murrumbidgee River. Wyalong is distant about forty-five miles from the Lachlan River, and about sixty-eight miles from the Murrumbidgee River, and is within a district remarkably free from watercourses. The Government township of Wyalong is sixteen miles N. 35° W. from Barmedman, and forty miles in a similar direction from Temora.

2. General Geology.

A. *General Remarks on the Geology of the District.*

The difficulty of making exact geological observations in the vicinity of Wyalong will be understood when it is explained that with the exception of the few widely-separated low elevations, such as the hill on which the hospital stands to the N.E. of Wyalong township, Pine Hill and Pine Ridge, the underlying rocks are nowhere visible at the surface. They are concealed by a covering of post-tertiary accumulations of red soil, &c., several feet thick. Our knowledge of them is mainly obtained from an examination of the surface soil, which occasionally indicates the nature of the underlying rock, and by openings, shafts, &c., made by miners in prospecting.

The difficulty of geological observation is increased by the absence of any exact knowledge as to the geology of the surrounding districts. In travelling from Barmedman to Wyalong—a distance of eighteen miles—no outcrops of rocks are seen.

In the vicinity of Wyalong there are, roughly, two main geological areas, which can be readily distinguished, and their boundary lines approximately shown. (*Vide* map).

One of these—the larger—is occupied entirely by granite, and in this the large majority of the reefs occur. The other, which seems to contain rocks of greater age than the granite, is occupied by highly altered sedimentary strata, and igneous rocks of intrusive character. The latter appear to vary in composition from intermediate to basic, and are also much altered.

The total area of the map presented with this report is thirteen square miles, of which more than two-thirds, or an area of about nine square miles, is occupied by granite, and the remaining four square miles by the sedimentary and associated intrusive rocks. The granite area occupies the whole of the western and the north-eastern portions of the map, the other area being confined to its south-eastern corner. The granite extends for miles in a northerly direction beyond the limits of the map, and probably, without a break, as far as Hiawatha—a distance of eight miles, in a direction N. 30° W. from Wyalong. At Hiawatha auriferous reefs have been quite recently discovered in the granite, which is apparently a continuation of the Wyalong mass. The granite also extends for some distance to the south of Wyalong; and westerly towards Yalgogrin the same rock extends continuously for two or three miles, and then in belts alternating with belts of altered sedimentary rocks.

The smaller area appears to be occupied by altered sedimentary strata and intrusive rocks. To what extent either of these exist there it is impossible to say, as over by far the larger portion of this area no exact knowledge of the underlying rocks can be obtained owing to the covering of red soil.

The intrusive rocks consist of diorites and hornblende schists. The latter appear to have been formed through the dynamic metamorphism of the former. A low ridge of these rocks starts near the hospital, and extends in a semi-circular form to the Marsden Road. A second ridge in the south-eastern corner of the map, including Pine Hill and Pine Ridge, is very largely occupied by these hornblendic rocks. Enclosed in the last-mentioned mass of hornblendic rock are three narrow belts of highly altered sedimentary rocks. One of these extends down Pine Ridge in a N.N.E. direction. It is about seven chains wide, and consists of slates and quartzite. A reef extends along the eastern margin of this belt near its junction with the diorite. This belt can be followed for about ten chains down a narrow spur from the main ridge, its further extension being hidden by the superficial deposits of red clay, &c. A second development of sedimentary rocks occurs forty chains to the east of the first; it has a northerly trend, is ten chains wide, and consists of bluish-grey schistose slate.

A third band, whose width is not known, occurs near the Barmedman Road, and twenty chains N.E. of Pine Hill. The order of appearance of these rocks would seem to have been as follows:—In the first place the sedimentary rocks were formed, these were later intruded by the diorites, which became partly converted into hornblende schists, and, lastly, the granite was intruded alike into the sedimentary and diorite rocks.

The deduction as to the granite being of newer age than the diorites is based on the following facts:—

(1.) The close association of the diorites with the oldest rocks—the sedimentary strata.

(2.) The apparently greater metamorphism of the diorites than the granite. The former are frequently found converted into hornblende schist.

(3.) Although the actual junction line between the granite and the diorites is nowhere visible, still in two places small felspathic veins, apparently intrusive, were noticed in the diorite in the vicinity of its junction with the granite. These two dykes are in all probability offshoots from the granite mass, which have been thrust into the diorite.

B.—*Sedimentary Rocks.*

(*a*) Recent and Pleistocene.

Comprised under this heading are the most recent accumulations, which consist for the most part of red soil, with fragments of quartz and small nodules of ironstone.

Almost the whole area of the gold-field is occupied by these loosely aggregated sandy and clayey materials, which owe their origin largely to the decomposition and disintegration *in situ* of the underlying granite and diorites. The prevailing red colour of these deposits, as of most similarly coloured materials, is due to the presence of larger or smaller quantities of oxide of iron. This is derived from the iron-bearing minerals, biotite and hornblende, which occur in the granite and diorites, and impart to them their dark colour. The decomposition of these minerals sets free the oxide of iron.

This red colour of the surface soil is, perhaps, more characteristic of regions having a dry climate than in moist regions, for in the latter the decaying organic matter has a bleaching effect, due to the reduction of the ferric oxide and its partial removal in a soluble form. Part of the oxide of iron has separated out in the form of small ironstone concretions, which present a rounded pseudo-water-worn appearance, due to their mode of origin. The red colour of the soil is, on the whole, more pronounced and deeper over the area occupied by the diorites and hornblende schists than over the granite area. This arises from the larger percentage of iron in the former rocks.

Angular fragments of quartz are very numerous, especially in the neighbourhood of the reefs. In the absence of well-marked outcrops it was the presence of these fragments that led to the discovery of gold at Wyalong. Small rounded pebbles of quartz occur on the surface in several places. They were particularly noticeable on the mallee flat which extends between the township of Wyalong and Pine Ridge. Although during heavy rain water evidently flows over this flat, there does not appear to be any depth of deposit there or any accumulation of gravel, but the loose rounded stones are scattered irregularly over the surface and through the red soil.

These surface accumulations are sometimes clayey, as on the mallee flats, and sometimes sandy. The sandy portions occur especially on the sides of the gentle slopes, from which the lighter clayey particles have been largely removed by wind and rain.

Besides the concretionary pebbles of ironstone referred to above and known as "ironstone gravel," there are other masses of a concretionary nature which consist of varying proportions of the carbonates of lime and magnesia. These occur especially in the subsoil over the decomposing diorites. The decomposition of the hornblende and felspar of these rocks sets free lime and magnesia, which become readily converted into carbonates by the absorption of carbonic acid gas, which is carried down by rain from the atmosphere. Ordinary hornblende contains about 19 per cent. of magnesia and 14 per cent. of lime. Such concretionary masses were not uncommon in some of the auriferous leads in the Colony where these leads overlay dioritic or andesitic rocks. They occurred at the base of the wash or in the decomposed country of the "bed-rock," and were known to miners as "clinkers."

(*b*) Silurian (?).

There appears to be but a very small development, in the vicinity of Wyalong, of these ancient sedimentary rocks. The existence of three narrow belts has already been noted and their positions described. They

consist of highly altered sedimentary rocks, schistose slates, and quartzites, which have undergone considerable alteration. No fossil remains have yet been found in any of these sedimentary beds. It is highly probable that all traces of fossils have been obliterated during the alteration of the rocks. In the absence of fossils it is impossible to determine their exact geological age. On other evidence they may be provisionally classed as Silurian. The comparatively recent discovery of Lower Silurian fossils in rocks in two localities in the Colony, viz., at Tomingley, near Peak Hill, and in the parish of Alexander, county of Wellesley, and near the Victorian border opens up the possibility of such strata as those at Wyalong being Lower Silurian and not Upper Silurian, as the practice has previously been to call, provisionally, large areas of rocks in the western portion of the Colony, which, as yet, have furnished no fossil evidence as to their true age.

Some of the sedimentary rocks near their junction with the dioritic rocks contain epidote; the presence of this mineral is evidently due to chemical changes produced by the intrusion.

C.—*Eruptive Rocks.*

To this class belong the granite and diorites. The most important rock, from an economical point of view, is certainly the granite, which contains nearly all the gold-bearing veins worked in and around Wyalong.

The probable extent of the granite, and its relation to the area occupied by sedimentary rocks and the diorites, have already been described.

Along the main lines of reefs the granite has been considerably crushed.

The crushed material of these zones is locally known as the "formation," and the space occupied by it as the "channel."

These local terms will be occasionally employed in describing the reefs.

When seen in mass the granite exhibits a distinctly gneissose appearance. In places near the channel the intense pressure to which the rock has been subjected has produced a distinctly schistose structure. In these cases the rock is sometimes wrongly called by miners a slate. The mineral-bearing solutions, which have circulated through these crushed zones of rock and deposited the minerals of the veins, have produced chemical changes in the granite, which impart to it a dull green colour. The rock so acted upon is frequently called "serpentine" by the miners; to this rock it bears but a superficial resemblance, but differs from it entirely in chemical composition.

The alteration produced by the mineral-bearing solutions extends for some distance into the walls of the lodes, and when met with in deep underground workings is a sure sign of the proximity of a crack or fissure, through which the solutions have travelled. Sometimes in the solid granite a little vein of quartz, perhaps not more than an eighth of an inch in thickness, is bounded on each side by a band of altered rock several inches in thickness. This is the same phenomenon as is met with in large reefs and lodes, where the ore-body is bounded on each sides by a strip of altered rock, usually softer than the unaltered country-rock, but occasionally harder by the deposition of secondary silica.

This alteration is, of course, quite distinct from that almost universally met with in the upper portions of lodes and the surrounding rocks, where water charged with carbonic acid gas, organic acids, &c., percolates through the rocks, and accumulates at a certain level known as the water-level. The effects of this percolation downwards of water from the surface is to soften and decompose the country-rock, and to produce great changes in the mineral contents of the lodes.

To this must be ascribed the decomposition of iron pyrites in the Wyalong reefs with the production of ironstone and gossan, and accompanied by the setting free of gold in a fine state of division.

The granite has been softened and decomposed over the Wyalong Goldfield to a mean depth of about 150 feet, and down to that level it was capable of being worked by pick and shovel alone.

The undecomposed granite is a medium-grained holocrystalline rock of a mottled grey and black appearance. It has a distinctly gneissose structure, which is especially well-marked in large specimens; the dark constituents, hornblende and biotite, have a roughly parallel arrangement, thus imparting to the rock a distinctly banded structure. Irregular patches, varying much in size and darker in colour than the general mass of the rock, are not uncommon. These, which graduate into the surrounding rock, are apparently more basic in composition, and finer-grained than the rest of the rock.

Such masses are original, and would seem to have become separated out during the cooling of the magma. The minerals present in the granite are felspar, quartz, hornblende, biotite, and in much smaller quantities apatite and epidote.

The following analysis of a typical sample of the rock taken from the Klondyke Mine was made in the Departmental laboratory.

The low silica percentage shows that this rock should be more strictly termed a quartz-mica diorite; but the term granite has been used throughout this paper in its popular sense:—

Analysis.

Moisture at 100° C.	0·13
Combined water	0·73
Silica (SiO_2)	58·93
Ferric oxide (Fe_2O_3)	1·73
Ferrous oxide (FeO)	5·01
Manganese oxide (MnO)	trace
Alumina (Al_2O_3)	17·48
Lime (CaO)	7·08
Magnesia (MgO)	4·33
Potash (K_2O)	1·34
Soda (Na_2O)	2·91
Titanic acid (TiO_2)	0·52
Vanadium pentoxide (V_2O_5)	strong trace
Phosphorus pentoxide (P_2O_5)	0·14
Sulphur trioxide (SO_3)	absent
	100·33

Perhaps the most interesting feature about the microscopic structure of this rock—at least from a mining point of view—is the existence of lines of crushing, along which the quartz is highly crushed, and presents the appearance, almost, of having flowed round the other minerals. The biotite mica is also drawn out and contorted. The analogy between these lines of crushing and the crushed zones, which form the so-called "formation" of the miners, and contain the rich gold-bearing veins of quartz, &c., is evidently very close. Both, in all probability, owe their origin to the same cause, viz., lateral pressure.

A rock whose field-relations to the granite and diorites I was unable to satisfactorily determine is typically developed on the hill on which the house occupied by Mr. Warden Clarke stands. This rock, which has been identified as a norite by Mr. Card, seems to occur as a narrow zone separating the granite from the diorites. The first specimens of this rock were collected previous to my visit, and are said to have come from the hill just mentioned, which is about one mile north of Wyalong Post Office.

The sections of this rock show it to contain little or no quartz, a very large amount of felspar (plagioclase), and a considerable amount of hypersthene and hornblende. The specimens collected by myself from apparently the same mass contain quartz, felspar (plagioclase), a large amount of hornblende, and perhaps a small quantity of hypersthene.

This rock, therefore, differs in mineral composition from both the granite and the diorites.

An important feature of this rock, and one that seems to connect it with the granite, is the presence in it of veins of coarse pegmatite. These have all the appearance of having separated out before the consolidation of the mass of the rock.

The following is a brief description of the microscopic characters of some of the rocks, which is given for the information of those who are specially interested in this subject.

I have much pleasure in acknowledging the assistance of Mr. G. W. Card, A.R.S.M., Curator and Mineralogist, in the microscopic examination of the rock sections.

*Granite.**—Microscopic sections were cut from four specimens of the rock collected from four different mines. They are: 1889†—Welcome Stranger Mine, 134-foot level; 1888—Lighthouse Mine, 160-foot level; 3,228—Currajong Mine; ——(?)—Gorman's Claim, 225-foot level.

The essential constituents of this rock are felspar, quartz, hornblende, and biotite, and the accessory ones are apatite and epidote.

The felspar appears to be entirely plagioclase, probably oligoclase, no orthoclase or microcline being recognised in any of the slides. The crystals show multiple twinning; in many instances both the albite and pericline types are to be seen in the same individual. Zonal structure is not uncommon, several of the crystals having a core, in which secondary minerals due to alteration are present, surrounded by zones of comparatively clear felspar. This makes it probable that the felspars have been growing *in situ* since the consolidation of the mass. Some of the felspars are shattered, with slight displacement of the portions. Kaolinisation has not taken place to any great extent, and is most marked in the central (? older) portions of some of the crystals.

The hornblende is in part idiomorphic, and the cleavage is well marked in cross-sections. Two varieties of this mineral seem to be present; one usually with idiomorphic outline, and the other more massive, and of a darker colour, and strongly pleochroic, with tints varying from emerald green to a deep blue-green.

The mica, the ordinary dark magnesium variety biotite, is much distorted and bent, and has a disposition to run in bands. Much of the biotite has undergone alteration into a pale green, and even colourless variety, with loss of iron compounds.

Epidote seems to make its appearance as a result of the alteration. Quartz is present, but in distinctly smaller quantity than the felspar. The main feature of this mineral is its crushing. Even in ordinary light the quartz can be seen to be crossed by a number of narrow cracks, but under crossed nicols it almost invariably breaks up into numerous small areas with irregular outline, and accompanied by complete loss of optical continuity.

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* This name is used in its popular sense, but by many petrologists it would be more strictly called a quartz-mica diorite.

† This refers to the number in the official register of rock specimens.

The crushing has resulted in the production of granular aggregates, which seem to have flowed round the felspars and other minerals. The quartz is the only mineral in the slide which exhibits this intense crushing; the felspars, with their perfect cleavage, contrary to what might be expected, have not suffered to any extent. This is, however, quite in accord with general experience, viz., that quartz is one of the first minerals to disintegrate under pressure.

Apatite and epidote have been mentioned as accessory minerals. The former occurs only in small quantity, and appears in sections as small glassy crystals. The epidote is certainly a secondary mineral, and in the sections is wholly associated with biotite which is in an advanced state of decomposition. It occurs usually in elongated masses of irregular outline, which lie along the cleavage planes.

The epidote is bright yellow in section, is pleochroic, and polarises in very high colours.

Norite.—This is a holocrystalline rock, consisting of plagioclase, hornblende, hypersthene, and magnetite, with also small quantities of biotite and apatite. The plagioclase is the most abundant constituent; it is probably a lime-soda felspar, is very fresh, and shows multiple twinning extremely well, probably on the albite type.

There are numerous inclusions in the felspars, which on the whole have no definite arrangement. The felspars are not shattered, but there are indications of strain. Hypersthene is present as an original constituent; it occurs generally as grains with irregular outlines, but occasionally exhibits prismatic form. The following is a description of this rock, written by Mr. G. W. Card, A.R.S.M., in 1896*:—"The norite is a medium-grained dark-grey rock, having a specific gravity of 2·76, and a silica percentage of 50·60. The minerals present are plagioclase felspar, hypersthene, hornblende, magnetite, zircon, apatite, and probably quartz.

"The felspar, which is fresh and abundant, has not yet been determined. Twinning is almost entirely on the albite type; and the felspar is to some extent schillerized. Hypersthene is very representative, exhibiting the characteristic pleochroism, cleavage, outline and straight extinctions. A paramorphic (?) change to hornblende can be traced step by step from a peripheral fringe of fibrous material to crystals of hornblende containing residual hypersthene, and, by inference, to hornblende in which the transition is complete. There would appear to be a close analogy between the changes here referred to and those described by Williams and Chester in the norites of Baltimore and Delaware respectively. The hypersthene is traversed by deeply-stained cracks. The hornblende is generally green in colour, and exhibits well-developed cleavage cracks when of appreciable mass. It is probably entirely secondary."

Mr. J. B. Jaquet, A.R.S.M., refers† to a similar change in a rock from Kiandra, in which the "majority of the grains (of hypersthene) have partially undergone a paramorphic change, and are fringed with green hornblende."

Other specimens (Nos. 3,235, 3,238, and 3,233 in the Official Register), which I collected from the zone in which the norite occurs, are less basic, and may possibly represent intermediate types between the granite and the norite.

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* Records Geol. Survey N.S. Wales, V, Pt. 1, pp. 13-14.
† Records Geol. Survey N.S. Wales, V, Pt. 3, p. 117.

All these contain plagioclase felspar, hornblende, quartz, magnetite, and apatite; Nos. 3,235 and 3,233 also contain probably a little hypersthene, and Nos. 3,238 and 3,233 also a little biotite much decomposed.

In all quartz is present in appreciable quantity, and occurs in clusters of grains which have partly rectangular outlines, and polarise simultaneously in a manner somewhat resembling the behaviour of the same mineral in graphic granite.

In regard to the diorites, the sections show that some of the rocks are typical diorites, consisting of hornblende and plagioclase felspar, while others appear to mark stages in the formation of hornblende schist.

PART III.

Economic Geology.

1. *Absence of Alluvial Gold.**

The absence of alluvial gold at Wyalong is one of the most noticeable features of the gold-field, and one in which it differs from nearly all other large gold-fields of the Colony. The existence of so many rich veins at the surface makes it extremely probable that these veins have suffered denudation to some extent. Had the other circumstances therefore been favourable alluvial deposits would have been formed. In the absence of these deposits we must, therefore, conclude they have not been so. The unfavourable circumstances are—

(1.) The absence of hills and gullies, the country being flat, where natural sluicing operations could take place;

(2.) The small rainfall; and

(3.) The exceedingly fine state of division of the gold, which as set free would probably be scattered by the action of the wind and rain storms, which are so frequent in these regions. It is thus probably dispersed through the surface accumulations that cover a large part of the surrounding country.

2. *The Ore Channels.*

Reference has already been made to the nature of the ore channels in the remarks on the granite. The reefs usually occur in a zone of crushed granite; this is a constant feature on the main lines of reef. The width of these zones varies considerably; for instance, on the Mallee Bull line of reef it is as much as eight or ten feet wide in places, and narrows down occasionally to a foot or less. They seem to owe their origin to the force of lateral compression, and resemble shear zones.

3. *General Remarks on the Gold-bearing Veins.*

The gold occurs in a number of veins composed largely of quartz, and, in the upper zone above the water-level, ironstone with sulphide ores below.

The veins occur as a more or less parallel series with a general trend ranging, with one exception, from due N. and S. to 20°, or even occasionally 30°, to the E. of N. and W. of S. They dip easterly at varying angles. The sole exception to the general trend is found in the case of the Pioneer line of reef, which has a nearly due E. and W. trend and a northerly dip.

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* *Vide* introductory letter.—E.F.P.

There are about a dozen of these lines of reef within an area of about one and a half miles square. Some of the most important of them have received names, as Klink's line of reef, Mallee Bull line of reef, &c.

The reefs are, on the whole, of small size, and may be said to vary in width from an inch or two to a foot or eighteen inches, occasionally becoming as much as three or four feet in thickness.

In many of the mines the mean thickness of the reef cannot be more than eight or nine inches, but in others it may be as much as one foot or eighteen inches. On some of the smaller lines the reef is enclosed by tight granite walls, but usually there is a zone of crushed material, and the reef occurs on either side of this, or even within it. Not uncommonly the reef splits up into several portions, of which one may occur on either foot or hanging wall, and the other somewhere within it. Frequently the crushed granite occupies the whole of the space, and no reef is present.

The veins are lenticular in character, pinching in and widening out very rapidly when followed either horizontally or vertically. Polished surfaces or slickensides are occasionally met with, as well as narrow veins of a black material, consisting of crushed iron pyrites. These phenomena make it clear that some movement has taken place since the formation of the reefs. Polished faces of quartz were noticed in the Klondyke Mine, and grooved and polished masses of iron pyrites in the Lucknow Mine, on which gold is often visible as a thin film.

The largest constituent of the reefs is, of course, quartz; but, especially in the upper zone, calcite and gypsum are also sometimes present in small quantities as gangue minerals.

The metallic minerals in the unoxidised ore consist principally of iron pyrites, with comparatively small quantities of galena and zinc blende, and in the oxidised portion ironstone or hydrated ferric oxide, and sometimes a little carbonate of lead (cerussite) is visible. Native copper with stains of the carbonites are also present in one or two of the reefs.

Quartz occurs chiefly as the white opaque variety, but is colourless and glassy in places. A dull, horny variety was also noticed in one or two reefs.

Opal is also present in the reefs. It is usually of a reddish-brown colour, due to the presence of ferric oxide, but sometimes it is opaque, white, or even occasionally clear and colourless.

In this mineral fairly coarse gold is usually visible. As far as I could learn, it always occurs associated with quartz and ironstone in the upper or oxidised portions of the reefs, and not in the unaltered portions below the water-level. The presence of ferric oxide in this opal, as well as the fact of its being confined to the upper portions of the reefs, point to the probability of its being deposited in the reefs from solutions percolating from the surface. The presence of fairly coarse particles of free gold in the opal is an interesting feature, as the gold in the rest of the oxidised ore, as well as in the sulphides, is in a very fine state of division. If the opal has been deposited from solutions percolating from the surface, the gold has been derived from the same source; its very fine state of division would favour its passing into solution.

The ironstone is evidently derived from the oxidation of iron pyrites, which latter is present in all the reefs below the water-level. The ironstone is often very compact and dense, and is usually very rich. This is so generally rich that stone containing much of it is always treated by chlorination, as experience has shown that a large portion of the gold cannot be saved by the ordinary battery treatment.

Small quantities of native copper are found in the Klondyke Mine near the base of the water-zone. It occurs chiefly in cracks in the quartz, forming thin, sheet-like masses on the faces of the quartz, from which it may be readily detached.

Below the water-level iron pyrites, galena, and zinc blende occur in the reefs. The two last-named are only present in small quantities. The iron pyrites, on the other hand, is occasionally present in small veins from an inch or two to a foot in thickness, in a fine-grained, compact form. Veins of this mineral with small quantities of galena and zinc blende were being worked, at the time of my visit, in the Lucknow Mine. This ore was very rich, and went in bulk from 20 to 25 oz. of gold to the ton.

The most important constituent of the reefs is the gold. It is almost invariably present in a fine state of division. This remark applies to the ore from both the oxidised and sulphide zones. In the upper or oxidised zone through which surface waters have percolated, converting iron pyrites into ironstone and liberating the gold present in the sulphide ore, the latter is usually so fine that, even in rich ore, it is not readily noticeable except by the aid of a pocket-lens. As an exception to this rule, in one or two mines comparatively coarse gold has been found in the white quartz. This was notably the case in Stanley's Blow Mine, but also to a smaller extent in the Klondyke and Santa Claus Mines.

So closely associated is the gold with iron pyrites in the lower levels in the Wyalong mines that the presence of the latter is an almost infallible sign of their richness.

4. *Detailed Description of the Mines.*

It is now proposed to give a detailed account of the most important mines at Wyalong. The reefs have, on the whole, been found to run in well-marked lines, along which the different mines are situated. There are about a dozen of these lines of reef to be made out; these will now be described commencing from the most eastern one, or Klondyke line of reef.

Where returns from the mines are given, their absolute accuracy cannot be vouched for, as I have had to rely upon the figures given me by mine-owners and others interested in the mines. In the absence of legislation to compel mine-owners to furnish correct statements showing the yields from their mines there are no official records from which this information can be obtained. In many cases the figures given are incomplete. In the case of one of the most important mines on the field, viz., Neeld's Mine, the owners refused to furnish me with the information.

Klondyke Line of Reef.

This is the most easterly line of reef; it has been traced for a length of about fifteen chains, and has been worked principally in the Klondyke Mine. It has been traced northerly into Gatlan's lease, and southerly not beyond M. T. 217, unless a reef, which outcrops near the eastern boundary of G. L. 37, and which is being prospected by the United Australian Exploration, Ltd., is a continuation of it.

Klondyke Mine.—This is the only mine of any importance on this line. It is owned by Mr. Tyler. The reef in this mine, which has been opened up to a depth of 260 feet, is one of the few examples on the field of a true quartz reef, consisting, as it does, of a vein of quartz filling a fissure in the granite and bounded by well-marked walls. It strikes in a direction 30° E. of N.

and W. of S., and underlies at a steep angle to the east. In the last 100 feet, viz., between the 160- and 260-foot levels, the reef is practically vertical. Water was met with at 140 feet from the surface.

In the northern end of the mine there are two reefs above the 160-foot level, which junction at that level and extend downwards as a single reef. The eastern of these two branches dips at an angle of about 1 in 3, while the western one is nearly vertical. In the southern part of the mine there is a single reef down to 220 feet, where it splits into two portions. The accompanying section in the plane of the reef (fig. 1) shows a rich shoot of

Klondyke Mine.

Section along reef.

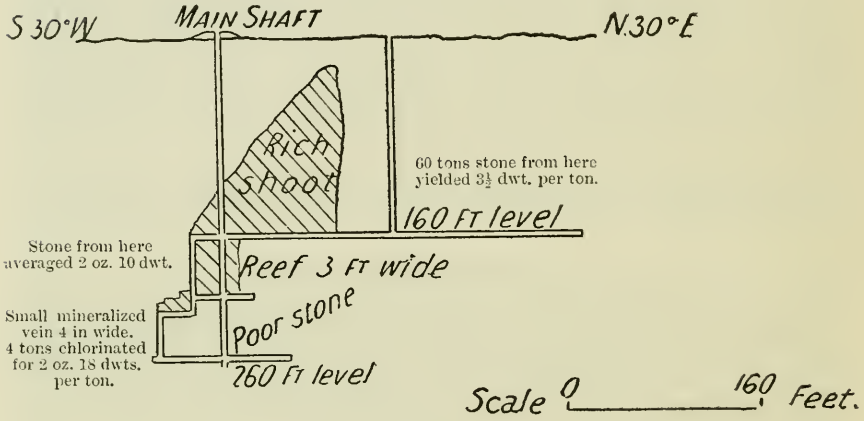


Fig. 1.

stone 120 feet long at the 160-foot level. This shoot has not yet been located at the 260-foot level. Immediately below the 160-foot level and north of the shaft, a reef 3 feet wide was exposed, the stone from which was expected to yield at least 2 oz. to the ton. At the bottom level north of the shaft the drive has been put in along stone of poor quality. In the roof of this drive native copper could be seen in the quartz; this was apparently always in the form of thin plates filling up somewhat rectangular cracks in the quartz. One piece given me by the manager is rectangular in shape, the two sides being about an inch in length and about an eighth of an inch in thickness.

The manager is strongly of opinion that the metallic copper was an unfavourable feature, and expected that when the copper disappeared the quality of the stone would improve. It may be so, but it is not clear how the presence of metallic copper could influence the gold contents of the stone.

In the south drive at the 260-foot level fairly good stone was met with, but the vein became split up. From one small vein about four inches in width, and carrying a fair amount of iron pyrites, four tons were taken and chlorinated for a return of 2 oz. 18 dwts. per ton.

The prospects of this mine are distinctly good, for the reef is a strong one, being one of the widest bodies of quartz in the Wyalong District, is well-defined, and should extend down to a considerable depth.

In 1897, 263 tons of stone were treated from this mine for a yield of 432 oz.

Gatlan's Lease.—The Klondyke reef has been traced into this lease (G. L. 47), and stone taken from it near the boundary is said to have been crushed for a return of 16 dwts. per ton. Near the north end of this ground a shaft has been sunk to a depth of eighty feet, and the reef was cut at the 50-foot level by a short crosscut. The reef there appeared to be of little value, being represented by a narrow band of crushed and decomposed granite. A small reef has been cut two chains west of the Klondyke line in this end of the ground. It is very small, and no stone has been raised from it.

Miner's Right M. L. 102.

This is about twenty-two chains nearly due north of the Klondyke Mine. The reef runs in a N.E. and S.W. direction, and is nearly parallel to the Klondyke reef. It has been worked intermittently for some time, but was practically abandoned at the time of my visit, on account of the low yield obtained from the last parcel of stone treated, viz., 40 tons for 11 oz., or at the rate of 5½ dwts. per ton. The reef is only a short one. A northern extension of it was worked in the mine known as Irwin's Blow, and 32 tons from it were treated at Barmedman for a return of 3 or 4 dwts. per ton.

Shamrock Mine.

Another short reef occurs in this mine. This reef, which was discovered by Mr. S. Hennessey, is approximately parallel to the Miner's Right and Stanley's Blow reefs, and is six chains W. of the former, and four chains E. of the latter. It strikes about N.E. and S.W., and dips to the S.E.

About two years ago 16 tons of stone were raised from this reef, and yielded 3 oz. 14 dwts. per ton. This was taken from a lenticular patch about 60 feet long, and varying from 6 to 18 inches in width. The first crushing of 9 tons taken from near the surface contained some coarse gold, and yielded 2½ oz. per ton.

The deepest shaft on this reef is 150 feet. Two men went into this mine recently with the object of removing the so-called "mullock" from the old stopes, but found it to be too poor.

Stanley's Blow Line of Reef.

The main workings on this line are thirty-five chains north of the Klondyke Mine.

To the north this reef splits up into two portions, which in Summergill's lease are about forty feet apart. To the south-west of Stanley's Blow the reef seems to continue on, but has not been worked to advantage. This line of reef was first found in Stanley's Blow Mine, where a large massive outcrop or "blow" of white quartz marked its presence at the surface. The greater part of this "blow" has been removed and crushed, and yielded fair returns; some of it contained coarse gold, the particles ranging in size up to that of grains of wheat.

Stanley's Blow Mine.—In this mine the reef averages about two feet in width, but it occasionally widens out to four feet. Several shafts have been sunk on the reef, the deepest being 190 feet.

Between 400 and 500 tons of stone have been crushed from this mine, of which 160 tons yielded at the rate of 6¾ dwts. per ton; 100 tons gave 8 dwts. per ton; 80 tons, 6½ dwts. per ton; and 45 tons, 7 dwts. per ton.

Recently the mine has been worked on tribute; the tributors have taken out about 43 tons, chiefly from the vicinity of the surface, which yielded about 7½ dwts. per ton.

Summergill's Lease.—Stanley's Blow reef is represented by two reefs in this mine. The two reefs are 40 feet apart. A crosscut from the bottom of the 150-foot shaft, sunk between them, intersects the western reef fourteen feet from the shaft. This reef varies from six to twenty inches in width, and 60 tons raised from it yielded 1 oz. 8 dwts. per ton.

A similar amount raised from the eastern reef gave 1 oz. 4 dwts. per ton.

Klink's Line of Reef.

This line crosses the road, connecting Wyalong and West Wyalong, about thirty-six chains west of the Klondyke Mine.

Gold was first discovered on this line of reef on the claim known as Harry's Find. Very good stone has been taken from this claim, but the mine that has produced by far the largest amount of gold is the one adjoining Harry's Find on the north, viz., Klink's.

This, which in the early days of this gold-field proved one of the richest lines, has not been traced with any certainty more than twenty chains. Its general strike is N. 10° E. and S. 10° W., and its dip is easterly. For a short distance the strike is nearly N.E. and S.W., and in the north end of Klink's Mine it seems to have taken a course somewhat west of north.

As on most of the other lines of reef, there is no well-marked outcrop, but below a foot or two of red soil it has been traced through Klink's Claim, where it is about seventy feet from the western boundary, through the centre of Harry's Find into the N.W. corner of the Victoria, and S.E. corner of the Frenchman's, and finally into the Catherine.

It has been doubtfully picked up in the adjoining claim to the south.

North of Klink's Mine the reef has not been followed, but in the adjoining claim, the Star of the East, two reefs have been found, either of which may be a continuation of Klink's reef.

N.N.W. of the Star of the East is the Ethel D., in which a band of crushed country "formation" has been met with. It is thought by some that this is a continuation of Klink's line of reef, but there is no evidence to show whether it is so or not.

The following mines were at work on this line of reef at the time of my visit, viz., New South Wales (the name applied to the two amalgamated mines formerly known as Klink's and Lighthouse), Harry's Find, Victoria, and Prince of Wales. In several others work had previously been done, but they were then idle; these are Star of East, Frenchman's, Catherine, Grand Junction, and Princess.

New South Wales Mine.—This includes the mines formerly known as Klink's and Lighthouse.

In the former mine (Klink's) the reef has been worked from the surface to a depth of 170 feet, and the ore obtained from it has been very rich. In the southern end of the mine the reef dips out of this ground into the Prince of Wales Mine, and in the northern end into the Lighthouse.

At about a depth of 170 feet from the surface there is a sudden change in the angle of dip of the reef (see fig. 2). From the surface to 170 feet the mean dip is about 45°; from that depth to where it was cut in the Lighthouse shaft the mean dip is as low as 17°. There was a very rich reef in this mine from the surface to 170 feet; from that depth downwards into the Lighthouse

New South Wales Mine.

Section across Klink's Reef.

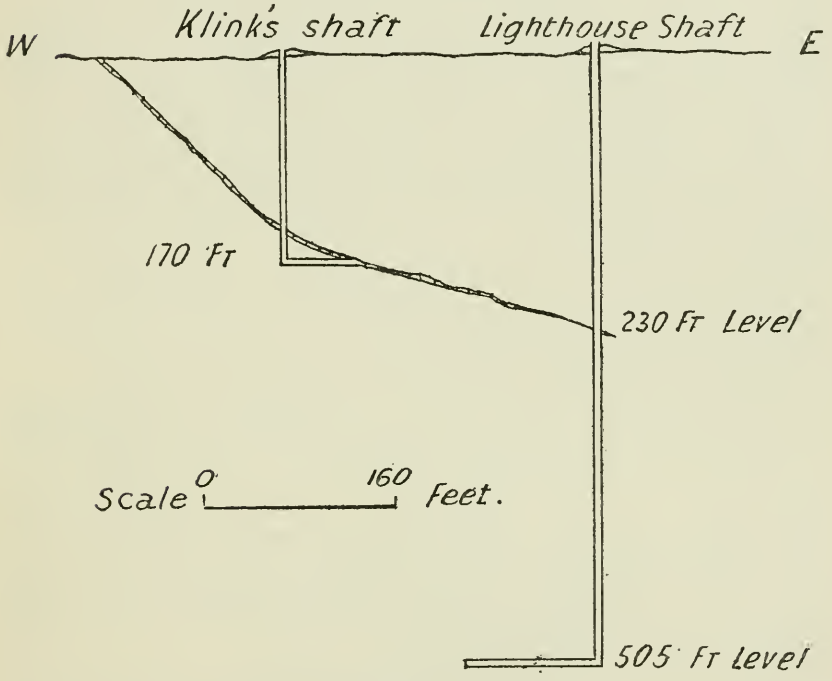


Fig. 2.

shaft no payable stone was met with, the reef between those two places being represented by a narrow zone of crushed and altered granite, with narrow lenticular bands of quartz. I regret my inability to get reliable information in regard to the returns from this mine, as it has been in the past one of the best dividend-paying mines on this gold-field.

Two parties of tributors were raising "mullock" from the old stopes in this mine. One party took out 218 tons of this material, which yielded 8 dwts. 19 grs. per ton, and 140 tons, which gave 5 dwts. 20 grs. per ton.

On the Lighthouse Claim a shaft was sunk to cut Klink's reef. This shaft has been sunk to a depth of 505 feet. A narrow band of crushed country was passed through at 230 feet from the surface; but as it was expected that the reef would not be cut in this shaft before a depth of 400 feet was reached, no notice was taken of this band. Later, Klink's reef was found to be continuous with this band met with at 230 feet, the reef having suddenly become very flat.

Between the Lighthouse shaft and the 200-foot level, in Klink's Mine, the reef appears at intervals, and is occasionally as much as a foot in thickness. But in many places no reef is visible, the channel being entirely

occupied by crushed granite. Levels were put in near the Lighthouse shaft, and 50 tons of quartz were raised from a reef, which averaged about 4 ins. in thickness.

The stone yielded 10 dwts. per ton, a return that was not payable, by reason of the small size of the reef and the difficulties of working it.

It is still thought probable by those interested in this property that the flat reef cut in the shaft at a depth of 230 feet is not the main reef, but that another will be found much steeper in dip, which was not cut in the shaft. In support of this view, they point out that at the bottom of Klink's 170-foot shaft, where the reef as exposed suddenly flattens, the country is much disturbed, making it possible that the main reef has been missed in this disturbed country, and that what has been followed is only a flat offshoot. It is also pointed out that in the Star of Peace Mine two reefs were found, of which the western one had a much steeper dip than the eastern.

I saw no evidence of a second reef. This point will shortly be decided, for a crosscut to the west is being put out from the bottom of the 505-foot shaft.

This had been extended more than one hundred feet at the time of my visit, and no reef had been cut; another twenty or thirty feet more should definitely settle the question.

Harry's Find.—This adjoins Klink's on the south; it was originally taken up by the Neeld family, and has remained in their hands ever since.

The reef has been worked by tributors down to the 150-foot level, where it passes into the Prince of Wales lease.

The shoots of rich stone in this mine dip apparently to the north.

Victoria Mine.—This is on the south side of Harry's Find. The outcrop of the reef passes through the N.W. corner of the claim. Its general strike is nearly due N. and S., and its dip is easterly. The reef in this ground is very flat, dipping at a mean angle of about 30° between the surface and the 160-foot level. It varies in thickness from an inch or two to two feet, and averages about nine inches. Very good stone was obtained near the surface in the northern end of the ground; but at the southern end no stone of any value has been obtained below eighty-five feet. The reef below that level is a foot or more in width, and consists of hard white barren quartz highly charged with black oxide of manganese. Normal faulting on a small scale was visible in several places in the mine.

Prince of Wales Mine.—This mine is on a block claim adjoining Klink's and Harry's Find on the east. The original shareholders were Messrs. Sladen and Naylor, by whom the ground was taken up. The property passed into the hands of the present owners, the United Australian Exploration (Ltd.), in June, 1897, who are reported to have paid £4,000 for it. Mr. A. S. Boucher is the superintendent engineer, and Mr. J. Gunther, the manager. There are two working shafts; a main one, which is vertical to a depth of 275 feet, cut through the formation at 225 feet. The other shaft, sunk near the S.W. boundary of the ground, is vertical to 175 feet, and then follows the underlay a further distance of 285 feet. Owing, however, to the extreme flatness of the reef, the vertical depth gained by sinking the last 285 feet on the underlay is probably not more than 80 feet.

Levels have been opened up at 225 feet from the surface. The reef along this level varies from an inch or less to a foot in thickness, and averages about five or six inches. In many places no reef can be seen, only a line of fracture, with more or less shattered granite in it. The general strike of the reef at this level is N. 10° E. and S. 10° W., and the mean dip from the bottom of the 175-foot shaft to the lowest point reached cannot be more than 17°. In places the reef is quite flat.

There are about twenty tons of rich ore and ninety tons of second-grade ore at grass.

Santa Claus Line of Reef.

This line of reef is distant about six chains west of that just described, and, like it, has produced large quantities of rich stone. It has been traced for a distance of about forty-five chains. Its general trend is N. 17° E., and its dip is easterly.

The following mines are situated on it, viz.:—Santa Claus, Aladdin, Erin's Isle, Monte Christo, Shamrock and Thistle, Waratah, and Ante-up. Of these, by far the most important is the Shamrock and Thistle.

Santa Claus Mine.—This was one of the original discoveries of the Neeld family. The reef is small, and does not average more than 4 or 5 inches in thickness, and occasionally splits up into several smaller veins. Some beautiful specimens of coarse crystalline gold were found in vugs in a dense grey quartz at the 128-foot level, which is the greatest depth at which work has been done in this mine. A total of 443 tons of stone have been raised from this mine between the surface and the 128-foot level, and been treated for a total return of 680 oz., or at the rate of 1 oz. 11 dwts. per ton. The best return was from a parcel of 6 tons, which yielded 42 oz., or 7 oz. per ton.

There was practically no work being done at the time of my visit in the Aladdin, Erin's Isle, and Monte Christo Mines. They have all been worked down to the water-level, or about 150 feet, and the two last-named are said to have yielded fairly large quantities of payable ore.

Shamrock and Thistle Mine.—This was formerly known as Conway's Mine, after the name of its discoverer. Rich stone was met with in this mine at the very surface, and a rich shoot of ore has been worked continuously to the 230-foot level, and has been picked up at the 330-foot level (see figs. 3 and 4).

Shamrock and Thistle Mine.

Section along reef.

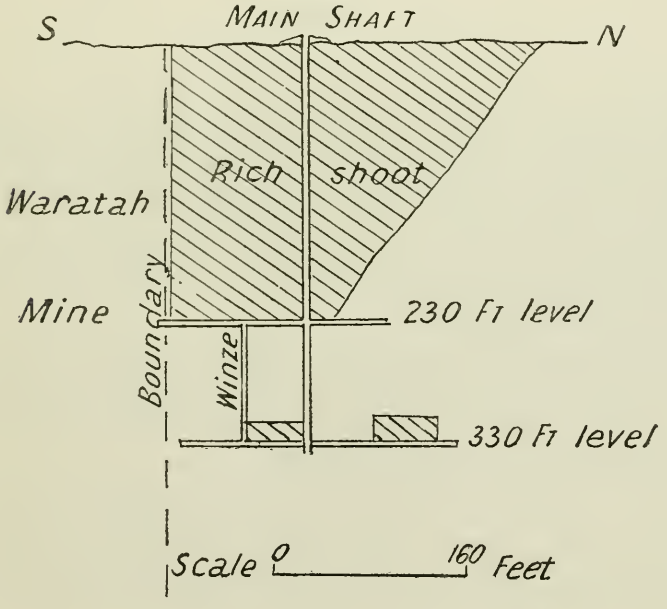


Fig. 3.

The mean dip of the reef between the surface and the 330-foot level is about 60°. Between the surface and the 230-foot level the ground has been worked out, but between that and the 330-foot level it has not been opened up to any extent. A winze fifty feet north of the shaft, connecting these levels, is said to have passed through good stone. In the bottom level

Shamrock and Thistle Mine.

Transverse section across reef.

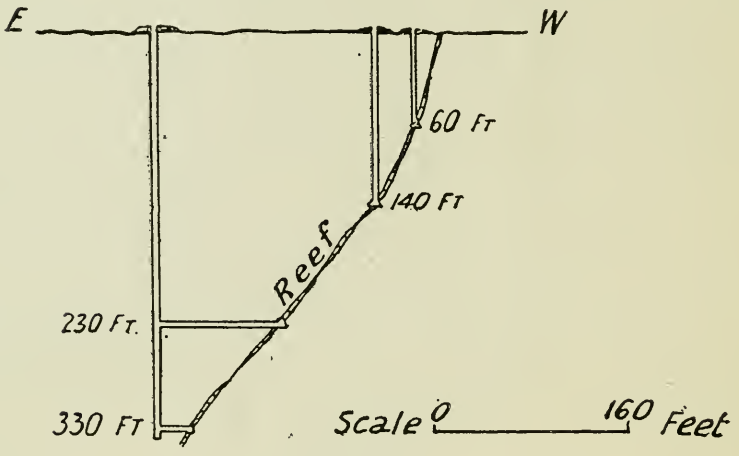


Fig. 4.

the rich stone seems to extend fifty feet south from the shaft, but a further thirty feet driven towards the Waratah boundary has exposed no reef of any importance. In the north drive, at the same level, no reef was met with for a distance of fifty feet from the shaft, but for the remaining sixty feet the drive passes through a highly mineralised reef, nine or ten inches in thickness. This stone is expected to yield 5 or 6 oz. to the ton. The rich mineralised ore from this level consists of glassy quartz, highly charged with iron pyrites and small quantities of galena. A sixth interest in this mine was recently sold for £1,750.

Waratah Mine.—This mine adjoins the Shamrock and Thistle on the south. The strike of the reef is N. 7° E. and S. 7° W., and the dip is easterly. The average width of the reef is about four or five inches, but occasionally it widens out to three feet. Some rich stone has been raised from this reef between the surface and the 215-foot level.

Ante-up Mine.—This adjoins the Waratah on the south. A rich shoot of stone was met with about forty feet above the 160-foot level (see fig. 5). The reef is small, like most of the reefs of this gold-field. This mine has produced 253 tons of stone, which yielded 546 oz. of gold, or at the rate of 2 oz. 3 dwts. per ton. The best return was obtained from 6 tons 14 cwt. of stone, which gave 8 oz. per ton.

There is a short line of reef running about midway between the Santa Claus and the Mallee Bull lines, on which the Young Australia Mine is situated. The reef in this mine has been sunk on for a depth of 230 feet. In the

Ante-up Mine.

Section along reef.

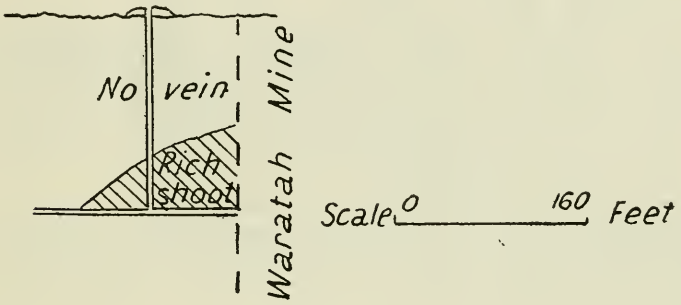


Fig. 5.

bottom it is well defined, and dips at an angle of about 80 degrees to the east. The returns from this mine are 103 tons of stone, for a yield of 163 oz., or at the rate of 1 oz. 12 dwts. per ton. Some of the stone yielded as high as 6 oz. per ton.

Mallee Bull Line of Reef.

This is undoubtedly the most important line of reef in the Wyalong Gold-field.

This line crosses the road connecting the Government township of Wyalong from West Wyalong, about one and a-half mile west of the Wyalong Post Office. It has been worked at intervals for a length of nearly one hundred chains, and on it are situated the richest mines of the field. It apparently gives off at the surface two important branches, one in Neeld's Prospecting Claim and the other in the True Blue Mine. The general strike of the main reef is N. 20° E. and S. 20° W., and its dip is easterly. The reef does not extend continuously from one end of the line to the other, for there are gaps where no reef is visible. What does persist from one limit to the other is the zone of crushed and altered country rock locally known as the formation. This can be traced throughout, and in some of the mines where a regular quartz reef has not been met with, as in the Brilliant, this zone is strongly developed, and often from six to eight feet wide. The average thickness of this reef is approximately about fifteen or eighteen inches. It widens out to two or three feet occasionally, and in one or two places to six feet or more, but it pinches in often to a few inches.

As to the value of the stone, it is as variable as the width. The richest ore has been obtained from the Lucknow Mine, from which bulk samples have been raised which have yielded as much as 25 oz. of gold to the ton.

From other portions of the reef along the line returns as low as 2 or 3 dwts. have been obtained. It is a pretty general rule along this line of reef that where ironstone or iron pyrites occurs in the stone in large quantities the stone is sure to be rich. The richest ore, viz., that from the Lucknow Mine, consisted of solid iron pyrites. As might be expected, the pyrites from the different mines, though usually rich, varies considerably in value ; thus some fragments from the Lady Hampden Mine, which resembled the 20-oz. stone that was being raised in the Lucknow Mine, on being assayed were found to contain only 3 oz. 14 dwts. per ton.

Of the two principal branches given off from the main reef, the northern one leaves it about the middle of Neeld's Prospecting Claim, and extends for about ten chains in a north-easterly direction into the Lady Grace Claim. The other branch breaks away from the main reef in the True Blue ground and extends for at least twenty chains in a nearly due south direction.

On this latter branch the Junction Mine is situated.

On the main line of reef are Neeld's Mine (the prospector's), and to the north of this the Bantam, Lucknow (formerly known as Bolte's), Daisy, and Ironbark Mines ; and south of Neeld's are the Lady Hampden, Brilliant, Mallee Bull, True Blue, Grand Central, Mallee Cow, Empire, Perseverance, Ledger, and Maiee Mines.

Of these, the most important are Neeld's Lucknow and True Blue Mines.

Gold was discovered on this line first in Neeld's Prospecting Claim ; this has proved to be the most important discovery made by the Neeld family at Wyalong. This line of reef has been the most productive on the gold-field, and there is every probability that it will prove the most permanent.

Neeld's Mine.—This mine is, perhaps, without exception, the richest on the gold-field. The general strike of the reef is about N. 12° E. and S. 12° W., and the dip is easterly about 70°. A main vertical shaft was sunk to the east of the outcrop ; this is forty feet east of the reef at the 100-foot level, and fifteen feet east of it at the 200-foot level. The sinking of this shaft was being proceeded with. In the vicinity of the underlay shaft, which is four chains south of the main shaft, a branch comes off from the main reef and extends in a north-easterly direction into M. T. 103, lately known as the Lady Grace Claim. This branch has been worked down to a depth of 160 feet chiefly by tributing parties of miners. At the 200-foot level, the main reef, which is there about two feet wide, is separated by twelve or thirteen feet of more or less crushed granite from a small reef a few inches in width. At thirty-five feet south of the crosscut a small vein branches off from the main reef and traverses first a S.W. and then S. 15° W. direction. A drive sixty feet in length has been put along this branch, which varies from a few inches to a foot in width, and consists of hard, white quartz, which assays up to 1½ oz. per ton. Near the northern end of the mine rich stone has been obtained from the surface down to the 100-foot level ; this yielded from 2 to 15 oz. per ton, and averaged 4 oz. per ton. In the stopes above the 200-foot level in this end of the mine a reef which was as much as five or six feet wide in places was being worked, and very rich stone was being raised from it. In the southern end of the mine the ore seems to be on the whole much poorer, and was being partly worked by tributors ; but in this end of the mine a rich shoot of ore was being opened up at the 200-foot level at the time of my visit. More than 2,500 tons of stone were at grass, which would yield from 8 dwts. to 10 or 12 oz. to the ton.

The accompanying section (see fig. 6) along the line of reef in this and adjoining mines to the north shows the approximate size and positions of the

Mallee Bull Line of Reef.

Section along line of reef in Neeld's Prospecting Claim and Bantam and Lucknow Mines.

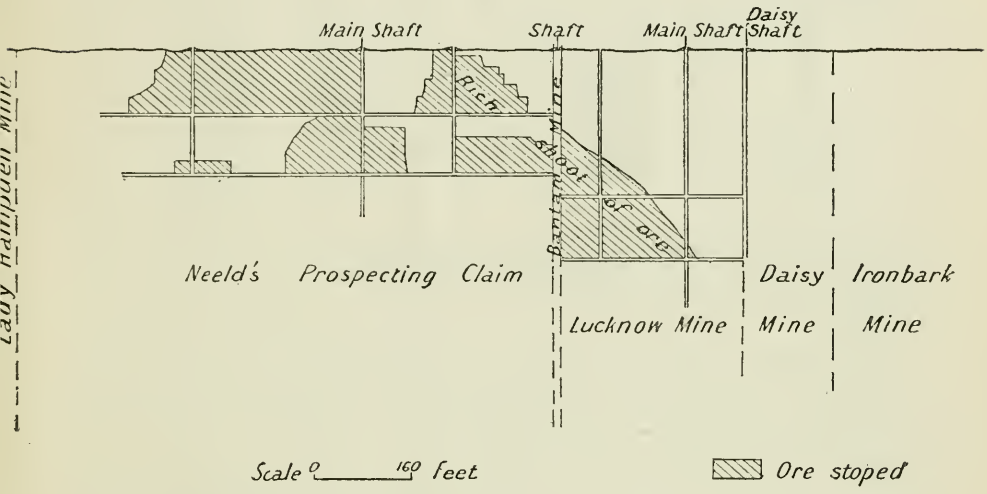


Fig. 6.

ore-bodies as at present exposed in these mines. The rich shoot of ore worked in the north end of Neeld's Mine appears to be dipping to the north, and to be continuous with that worked in the Bantam and Lucknow Mines.

Bantam Mine.—This is only a narrow strip of ground, seventeen feet wide, which separates Neeld's from the Lucknow Mine. It has lately been amalgamated with the Lady Grace, which is a block claim on the east, and into which the reef will probably extend at a depth. The amalgamated properties are now known as the Bantam Proprietary. A shaft has been sunk on the Bantam 406 feet in depth; for the first 125 feet it is vertical, and on the underlay for the remainder of the distance.

This mine has been in the hands of the present owners only since the beginning of this year; they paid £750 for it. Between February and August of this year £4,400 has been taken out of the mine, and £2,500 paid in dividends. About £2,000 has lately been spent in equipping the mine with haulage machinery and in cutting down the shaft.

Lucknow Mine.—This mine adjoins the Bantam on the north. A vertical shaft has been put down to the east of the outcrop to a depth of 336 feet.

The rich stone was not met with in this mine until a depth of 180 feet had been reached. At the time of my visit the payable stone had been worked out between the surface and the 236-foot level, but very rich stone was being raised from the stopes above the 336-foot level. This rich stone extends from the main shaft south to the Bantam boundary.

Some very valuable parcels of ore have recently been sent to Dapto from this mine. Of one parcel of 52 tons, 25 tons of first-grade ore yielded 23 oz. 13 dwts. per ton, and 27 tons gave 8 oz. 1 dwt. per ton.; of another parcel of 45 tons, 15 tons yielded 22 oz. 4 dwts. per ton; 7 tons, 7 oz. 1 dwt. per ton; and 23 tons, 4 oz. 13 dwts. per ton.

From the beginning of 1895 to October, 1898, the following returns have been received:—

tons	cwt.				oz.	dwts.	grs.
171	2	treated at Clyde Works, for		.....	791	5	0
5	4	,,	Footscray	,, ...	48	18	13
12	1	,,	Wallaroo	,, ...	173	0	0
23	6	,,	Bendigo	,, ...	80	0	0
187	16	,,	Ballarat	,, ...	1,473	7	0
17	18	,,	Climo's	,, ...	126	9	11
366	10	,,	Dapto	,, ...	2,894	3	11
Total ...783	17			,,	5,587	3	11

In addition to the above, 895 tons of lower-grade material were treated at the local batteries for a total yield of 639 oz. 16 dwts.

During the same period this mine has paid in dividends the sum of £12,545.

Daisy Mine.—This adjoins the Lucknow on the north. A shaft has been sunk close to the Lucknow boundary to a depth of 340 feet, and is vertical for the first 100 feet and on the underlay for the remainder of the distance. No reef of any value has yet been met with.

At the 300-foot level a drive was put in to the north on a very narrow vein, from which half a ton of stone was obtained, of the value of 6 oz. to the ton. The shaft is being sunk in a crushed zone of country rock 3 to 4 feet wide. An important point in the future prospects of this mine is the possibility of the rich shoot of stone now being worked in the Lucknow Mine dipping northwards into the Daisy.

It will be seen from the section previously referred to that the northern boundary of this rich shoot appears to be dipping to the north. If this dip is maintained, and the shoot continues downward, it should be met with in the Daisy Mine at from 100 to 150 feet below the present level of the Daisy shaft.

Ironbark Mine.—In this, which adjoins the Daisy on the north, the existence of two reefs has been proved. The deepest shaft is 251 feet in depth. At the 200-foot level there is a strong formation, which is as much as six or seven feet wide in places. At the 80-foot level there is a reef at least two feet wide, but the stone is of very low value. Twenty tons of stone were raised from near the surface, and yielded about 5 dwts. per ton. This seems to be the average value of the stone opened up in this mine.

This line of reef has not been traced any further to the north.

Lady Hampden Mine.—This, which includes only a narrow strip of ground along the line of reef, adjoins Neeld's Mine on the south. The reef was cut in the shaft at 100 feet, and followed down to a depth of 204 feet. It was thought by the managers of this and the adjoining mine, the Brilliant, that the workings in these two mines were probably not on the Mallee Bull line, but on a branch from it. Until Neeld's reef has been traced into the Lady Hampden Mine it will not be possible to say whether this is so or not; but I am inclined to think they are on the main line. From this mine 128 tons of stone have been raised and treated for a total return of 79 oz. 5 dwts., or at the rate of rather more than 12 dwts. per ton. The stone has varied in

value from 4 dwts. to 2 oz. per ton. A sample of pyrites brought down by me for assay gave a return of 3 oz. 14 dwts. of gold per ton, and 3 oz. 0 dwt 23 grs. of silver per ton.

Brilliant Mine.—This mine includes the claims formerly known as the Brilliant and the Treasure. Prospecting operations have been carried on with remarkable perseverance, although up to the present no payable stone has yet been met with. A shaft about 400 feet in depth has followed down the zone of crushed granite, which varies from three to eight feet in width. Lenticular masses of practically barren stone have been met with, and some pieces of stone showing free gold were found in the bottom of the shaft; but they did not resemble the rich stone found in the other mines on this line.

Mallee Bull Mine.—A large amount of work, both sinking and driving, has been done in this mine without proving the existence of a payable reef.

Near the surface loose lumps of rich stone were found, which were locally known as "spuds." These were evidently derived from the denudation of a rich vein in the vicinity, probably from the reef in the True Blue Mine. Seventy-three tons of these loose blocks were obtained, and yielded 128 oz. 8 dwts. of gold, or at the rate of 1 oz. 15 dwts. per ton.

Between the surface and the 170-foot level there are at least two reefs which are as much as two or three feet wide in places, but up to the present the stone in them has proved poor.

There has been raised from the reefs between the surface and the 100-foot level a total quantity of 347 tons, which yielded 159 oz., or 9 dwts. per ton, and 45 tons of second-grade stone, which gave on treatment less than 3 dwts. per ton. Mr. Channon has recently taken over the management of this mine; he proposes to experiment on the low-grade ore by dry crushing and cyaniding, and should this prove a failure further efforts are to be made to discover payable stone in the deep ground.

True Blue Mine.—This mine ranks next in importance to Neeld's and the Lucknow, at least on this line. The main Mallee Bull line of reef splits in this mine into two branches which diverge as they are followed southwards. The Junction is situated on the eastern one, and the Perseverance and Ledger Mines on the western one.

The two reefs have been opened up to a depth of 260 feet, and large quantities of stone have been stoped from them. They both dip to the east, the eastern one at a lower angle than the western; they are consequently becoming more separated as they are followed down. A winze was sunk on the eastern reef, 92 feet below the 260-foot level, and 30 tons of stone are said to have been raised from it which yielded 5 oz. per ton. Another winze was put down on the western reef from the same level, and to a depth of eighty-two feet. Nine tons from this winze are said to have yielded at the rate of 5 oz. 12 dwts. per ton, and 100 tons 17 dwts.; these parcels of stone came from a reef about 2 feet wide. I was unable to obtain the total returns from this mine.

Junction Mine.—This mine is situated on an extension of the eastern reef worked in the True Blue Mine. A vertical shaft cuts the reef at 315 feet from the surface. A large amount of rich stone has been raised from this mine, the full records of which I was unable to obtain. Three months previous to my visit 30 tons of rich pyritous stone were raised, of which 13 tons yielded 9 oz. per ton; 9 tons, 12½ oz. per ton; and 8 tons, 9½ oz. per ton. In addition to this 180 tons were treated at the batteries for a yield of 1 oz. 5 dwts. per ton. At the lowest level (350 feet) the rich ore seems to be extending into the adjoining claim, Maud's Jewel.

The mineralised reef in this mine varies from one to eighteen inches in width.

Napoleon.—Several shafts were sunk on this ground, the deepest being 150 feet, but nothing more than a narrow belt of crushed country rock was met with, in which very small veins existed. One ton of stone picked out from these veins yielded 14 dwts.

No reef of any value has been obtained in the Mallee Cow or Empire Claims. A small vein was cut in the former, from which 7 tons of stone were said to have been taken, and to have yielded 5 oz. per ton. In the Empire Claim a band of crushed granite, four feet wide, was driven on for a distance of thirty feet, but very little quartz was met with.

Perseverance Mine.—This mine has yielded a considerable amount of rich stone, and is said to have paid about £8,000 in dividends.

Work was suspended in this and the adjoining mine, the Ledger, and I was consequently unable to examine the workings in either of them.

In the Perseverance Mine a vertical shaft cuts the reef at 230 feet, and from this point it has been followed down to 280 feet. About 1,000 tons of quartz are said to have been raised from this mine, and treated for an average yield of about 2 oz. per ton. The shoots of rich stone are said to have dipped to the south in this mine.

Maiee Gold-mine.—This is the most southern mine working on this line of reef. A shaft 270 feet in depth intersects the reef at a depth of 250 feet, which is very small. In the south drive at the 270-foot level the reef is not more than a few inches wide.

Seventeen tons of stone were raised from this mine and treated for a return of 8 oz., or at the rate of 9 dwts. per ton.

Perry's Line of Reef.

This occurs about twenty-five chains west of the Mallee Bull line; there are only a few mines on it, and, with the exception of Perry's claim, they have not been payable. Only one mine was working on this line at the time of my visit; this was the Ready Money, which includes Perry's claim. Gold was first discovered on this line at Perry's claim, and was later found at intervals along it for a distance of thirty-five chains. The general trend is N. 25° E. and S. 25° W., and the dip is easterly and about 70°.

In the Ready Money Mine the reef is very small, only two or three inches thick, and occurs in a band of crushed granite two feet wide.

A small reef was cut in the Grand National Mine at 220 feet, but the only stone raised from this reef was 5 tons from near the surface, which yielded 16 dwts. per ton. In the Great Britain Mine the reef has been sunk on to a depth of 310 feet; it is rather small, but has yielded some good stone.

Another short line of reef occurs to the south of Perry's line; on it are the Central (formerly known as Pooley's) and Nil Desperandum Mines.

The reef or reefs, for in the Central there are several small veins, are small, but some rich stone has been taken out of them between the surface and about 150 feet.

Another short line of reef occurs ten chains west of the above; this is the Mouse Trap. The whole line was practically idle. The payable stone seems to have been removed from the surface to the 200-foot level. The reef is very small, and only averaged from four to six inches. The trend is N. 20° E. and S. 20° W., and the dip is easterly. The returns from the Mouse Trap Mine are 240 tons, treated by battery, for 415 oz., or 1 oz. 14 dwts. per ton; and 147 tons, treated by chlorination, for 881 oz., or 6 oz. per ton.

Currajong Line of Reef.

There are two reefs about 100 feet apart in the Currajong and Golden Fleece Mines, the two most important mines on this line. Their general strike is about N. 20° E. and S. 20° W., and the dip is easterly. The two reefs which occur in the Currajong Mine have not been traced with any degree of certainty north of that mine. It, however, seems probable that the main reef worked in the Hilderbrand, Yorkshire Lass, Two Up, and Dodger Claims is a continuation of the western reef of the Currajong Mine. To the south both reefs have been worked in the Golden Fleece and Keep-it-dark Mines.

Currajong Mine.—This is undoubtedly the most important mine on this line. There are two reefs—an eastern and a western one—both of which dip to the east. The main shaft, 310 feet in depth, is sunk between the two reefs, being eighty-seven feet east of the western reef at the surface, and twenty-seven feet east of it at the 310-foot level. The eastern reef is nearly vertical, being fifteen feet east of the shaft at the surface, twenty-two feet east of it at the 150-foot level, and twenty-five feet at the 230-foot level. (See Fig. 7.)

Currajong Mine.

Section across the reefs.

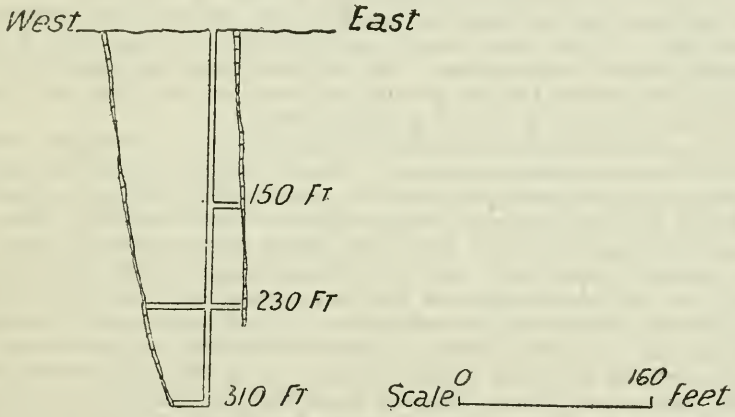


Fig. 7.

A large amount of stone has been raised from these two reefs. The western one is the richer of the two, and averages about nine inches in thickness.

This has been one of the most productive mines on the gold-field, and large dividends have been paid. I was unable to ascertain the amount paid previous to October, 1895, but since that date £13,700 has been received by the shareholders.

From August, 1897, to the present time, however, the proceeds from the mine have scarcely paid the wages of the miners employed. The mine is now being worked by two or three parties of tributors, who seem to be doing fairly well.

Hilderbrand's Mine.—This was a mine of some importance in the early days of the gold-field when rich stone was being raised from the soft ground.

There are at least three reefs, but they are all very small, and separated from one another by a few feet of granite. The stone has been stoped from this mine from the 150-foot level to the surface; from a vein three or four

inches in thickness stone yielding 8 oz. to the ton was obtained. These small veins appear to extend northerly into the Yorkshire Lass, Two Up, and Dodger Claims, from all of which small quantities of payable stone have been raised.

Golden Fleece Mine.—This is south of the Currajong Mine, and in it the same two reefs occur that are found in the latter. Most attention has been paid to the western reef, which has been prospected to a depth of 320 feet.

Recently 107 tons were treated from this mine for a total yield of 67 oz., or at the rate of 12½ dwts. per ton but large quantities of stone have been raised from this mine of which I have no record.

Keep-it-dark Mine.—The Keep-it-dark Mine lies to the south-west of the above; in it are the same two reefs, with a third to the west of them. From this mine 643 tons of stone have been raised for a yield of 883 oz., or at the rate of 1 oz. 7½ dwts. per ton.

Other Lines of Reef.

Operator, Red Flag, and Wye's Mines.—In the extreme western portion of the gold-field there are several lines of reef, some of which have yielded large quantities of rich stone while they were worked in the soft ground. But as work was suspended in nearly all of them at the time of my visit I was unable to examine them, and therefore can give very little information about them. In the south-western portion there are at least three reefs to the west of the Currajong line. The following mines on these reefs have yielded rich stone in the soft ground, viz., Operator, Red Flag, and Wye's; but little or no work is now being done in them.

In the extreme north-western corner there are at least five more reefs in addition to those already mentioned. None of them are large, but they are rich in places, and have been profitably worked while the granite was soft.

White Reef and Welcome Stranger Mines.—The White Reef Mine has been a very productive one; but at the present time the reef is small and the ground is very hard. In the Welcome Stranger Mine there are two reefs, but only the western one has been worked, and that only to a depth of 150 feet, the extent of the soft ground. In the south end of this mine, near the 4Js' boundary, a show of rich stone 200 feet long was worked out to the surface; this seems to have dipped to the south. The average width of the reef was six inches. Between June, 1894, and December, 1896, 1,178 tons of stone were treated from this mine for a yield of 4,860 oz., or at the rate of 4 oz. 2 dwts. per ton. This mine has paid in dividends £2,000 per share, or £16,000 in all. No work has been done in the hard ground, and the mine is now idle.

Hidden Treasure Mine.—In the Hidden Treasure Mine three reefs have been found; two of these are identical with those which occur in the Welcome Stranger Mine, and the third appears to be that worked in the Three Star and Homeward Bound Mines. A vertical shaft has been sunk on one reef, and a second junctions with this at 140 feet, and at 200 feet another small vein joins it from the east. The mean width of the reef worked in the vertical shaft is about three inches, and the richest stone was taken from it between the 90- and 180-foot levels.

This mine was abandoned for about twelve months; but was taken up again in February of this year. Since that date 30 tons of ore have been treated for a return of over 53 oz., being at the rate of 1 oz. 15 dwts. per ton.

Gipsy Queen and Star of Peace Mines.—Good returns have been obtained from the Gipsy Queen and Star of Peace Mines, but I am unable to give the figures.

Louisa Claim.—The Louisa Claim has yielded but a small quantity of stone; 57 tons are said to have been treated for a return of 78 oz. 7 dwts., or 1 oz. 7 dwts. per ton.

Homeward Bound Mine.—In the Homeward Bound Mine two reefs have been worked—one near the eastern boundary of the claim, and probably identical with the rich reef in the Welcome Stranger Mine, and the other is the same reef as that worked in the Three Star Mine.

Practically, all the work has been confined to the soft ground. On the first-mentioned reef two shafts, each 140 feet deep, and 150 feet apart, have been sunk, and connected by a drive; and a winze has been sunk to a depth of forty-seven feet below this level. At least 271 tons of stone have been raised from this reef and treated for a return of 453 oz. 3 dwts., or at the rate of 1 oz. 13 dwts. per ton; and 61½ tons from the other reef yielded 102 oz., or 1 oz. 13 dwts. per ton.

Three Star Mine.—In the Three Star Mine good stone yielding 1½ oz. per ton was found near the surface; but at 60-foot level the reef became much broken up, and at 160-foot level the reef averaged nine or ten inches in thickness, being as much as two feet in places, and 15 tons from it at that level yielded 1½ oz. per ton.

As the prospects seemed good a vertical shaft was put down; this, at 250 feet, was eighteen feet from the reef. At that depth the reef was found to be very small, from an inch or two to eight inches in width, and was firmly attached to the walls. Some driving was done on it at the lowest level; but as the prospects were not encouraging it was discontinued, and the mine has been lying idle for about twelve months. From this mine 327 tons were raised and treated for a yield of 348 oz., or 1 oz. 1 dwt. per ton.

Hill Top Mine.—The most western reef worked at Wyalong is that in the Hill Top Mine. It has been worked at intervals for a distance of 25 chains. In the Hill Top Mine it has been intersected by a crosscut 22 feet long from the bottom of a vertical shaft 230-foot deep. At this depth a drive 40 feet long was put in along the reef, which was found to be very small and of low value. About 300 tons of ore are said to have been raised from this mine from stopes between the 130-foot level and the surface. This stone averaged about 1 oz. per ton, but some of it yielded as much as 6 oz. 8 dwts. per ton. This mine is now idle.

Sunny Hill Extended Mine.—South of the Hill Top Mine, and on the same reef, is the Sunny Hill Extended, which includes what was formerly known as the Sunny Hill and Democrat Claims. From the north end of this mine about 300 tons of stone have been raised and treated for an average yield of 1 oz. 2 dwts. per ton. From the south end 150 tons of ore were raised, of which 18 tons yielded by chlorination 6 oz. 12 dwts. per ton, and the remainder was treated by the battery for a return of 9 dwts. per ton. This mine has not been worked for eighteen months.

Pioneer line of Reef.—The only other reef that it is necessary to describe is the one which forms the solitary exception in having an east and west trend. This is the Pioneer line of reef, on which the first discovery of gold was made.

The reef has been worked at intervals over a distance of twenty-five chains. It has a general strike of W. 10° N. and E. 10° S., and dips to the north. It has been worked in the following mines:—The Easter Gift (formerly known as the Dead Rabbit), Christmas Gift, Christmas Gift Block, Great Southern, and Pioneer.

Easter Gift and Xmas Gift Mines.—In the Easter Gift Mine the reef averaged about nine inches in width, but in the lowest level it was not more

than three or four inches. About 114 tons of ore have been raised from this mine for a yield of 160 oz., being at the rate of 1 oz. 8 dwts. per ton. In the Xmas Gift Mine the shaft is 240 feet deep, and the stone has been stoped out in blocks from 140-foot level to the surface.

The shoots of rich stone seem to dip westwards. In this mine, at the 240-foot level, the reef is on an average nearly three feet wide, but it is too poor to pay for its removal.

5. *Genesis of the Deposits.*

As regards the origin of the ore channels, I have already expressed the opinion that they are due to the shearing of the granite along a number of approximately parallel lines, by which the zones of crushed granite or "formation" were produced, and spaces, more or less lenticular in form, which have become later occupied by the veins.

The minerals filling the spaces and forming the veins have evidently been deposited from solutions which have circulated through them. But there is practically no evidence to indicate the ultimate source of the minerals, or to show whether the solutions that deposited them derived their contents from the immediately adjacent portions of the granite, or brought them up from some deeper-seated source, probably in the granite itself. What little evidence there is is in favour of the latter view, for the ascending solutions appear to have penetrated laterally for a short distance into the granite walls of the veins, to have altered the granite, and in some cases to have deposited minerals in it.

PART IV.

The Metallurgical Treatment of the Ores.

At the commencement of mining operations at Wyalong all the stone raised from the mines was sent to Barmedman, a distance of eighteen miles, for treatment by battery; but when the value of the reefs was proved it was not long before batteries were erected at Wyalong. It was not until considerable quantities of stone had been treated by the ordinary battery that it was found that this method was totally unsuitable for the treatment of rich ores; for it was found that a large quantity was going away in the tailings.

The subsequent treatment of these tailings by the cyanide method has been the source of great profit to the owners of Duncan's and Channon's Cyanide Works, who are said to have purchased large quantities of tailings at a merely nominal price, which contained more than an ounce of gold to the ton.

When the great loss of gold arising from the treatment of the rich stone by battery was recognised, chlorination works were erected.

There are at the present time, at Wyalong, three batteries, one Huntington mill, two chlorination works, and two cyanide works. All of these works were kept fully occupied during my visit. All were not, however, treating highly payable ore, as a considerable amount of so-called "mullock" was being put through the batteries while the cyanide works were almost wholly devoted to the treatment of tailings, of which large quantities had accumulated.

Of the batteries Nicolas and Reymond's is the largest; it consists of 22-head of stampers, two Frazer pans, and two concentrators.

Gough's battery consists of 15-head of stampers and shaking bubles. Between 1st January and the 30th September of this year 2,977 tons of stone were treated at these works for a return of 1877 oz. 14 dwts., or 12½ dwts. per ton, and 518 tons of mullock for a yield of 98 oz., or 3 dwts. 19 grs. per ton.

At West's battery, where there are 10-head of stampers, large quantities of "mullock" have been treated. This consists of low-grade material obtained from the dumps and from the old stopes in the mines. Material of this character naturally varies much in quality. From the beginning of the year up to the end of September 2,438 tons of this mullock were put through for a total yield of 371 oz. 18 dwts., or 3 dwts. per ton.

Mr. Cox has passed through his Huntington mill from the beginning of January to the 20th October of this year 1,688 tons of stone, which yielded 1,150 oz., or at the rate of 13½ dwts. per ton.

Wyalong Chlorination Works.—These were formerly known as Climo's works, as Mr. Climo was managing director at the time that they were erected; they are now owned by Mr. W. Sully.

They were started in 1895, but were not ready for the treatment of ore until the early part of 1897. They consist of a Krupp mill No. 6, a revolving roasting furnace, a cooling vat, 4 chlorination vats of a capacity of 24 tons each, and two cyanide vats of 45 tons capacity, also chlorine generators, &c. The present manager is Mr. Janitzky, and the accountant Mr. Shoobridge.

A very large amount of money has been spent on these works, but the results which have been obtained have not been altogether satisfactory. It seems doubtful whether the sulphide ores receive a sufficiently sweet roasting in the revolving furnace to enable a completely satisfactory extraction to be obtained. It has been found necessary in many cases to treat the material with cyanide solutions after their removal from the chlorine vats, in order to remove a further portion of their gold contents.

Stone, yielding from 1 oz. to 35 oz. per ton, has been treated at these works, in addition to 2,000 tons of tailings, varying in value from 5 to 25 dwts. per ton, and averaging ½ an ounce per ton.

At Neeld's chlorination works there is a Krupp mill with a reverberatory roasting furnace and nine chlorine vats. The capacity of this plant is about 40 tons per week.

Duncan's cyanide works have been established over two years. They are on the site formerly occupied by Gough's battery, where large quantities of rich ore were treated in the early days of the gold-field, with the production of rich tailings. These were acquired by Mr. Duncan, who has made large profits from the treatment of these tailings.

As the owner of this or other similar works do not give particulars of the amount and value of the tailings treated by them, no exact statement about these matters can be made. It is generally believed that a large part of these tailings have yielded more than an ounce of gold per ton. Concentrates ranging in value from 1 to 10 oz. per ton, and consisting largely of iron pyrites, have also been successfully treated at these works by the cyanide method.

A small plant was being erected at the time of my visit at these works to treat the raw pyritous ores by means of dry crushing and cyaniding.

I was informed that experiments had recently been conducted on the rich sulphide ores, with a view of ascertaining whether, by means of some modification of the cyanide process, these ores could not be more cheaply and advantageously treated by this method. I have been assured that on a small scale these experiments have yielded satisfactory results. Whether the gold is present in the free state or not in the sulphide ores is not known. If free, it must be in a very fine state of division, because gold is seldom visible in them. If it should prove possible to treat the sulphide ore successfully by the cyanide method, it will be a great boon to the field, as in nearly all

the deep mines sulphide ores are making their appearance; and, as this method is a much cheaper one than chlorination, it means that ores which would not pay by the latter process would yield a profit by the former.

Some large parcels of rich sulphide ores, especially from the Lucknow Mine, have been smelted at Dapto, but the expenses are rather heavy, amounting to £3 15s. or £4 per ton.

Channon's Cyanide Works.—These works are on the site of an old roller battery, owned by Mr. Channon, which proved a failure.

There are three large leaching vats, of a capacity of 35 to 40 tons each. Zinc filings are used for precipitating the gold from the cyanide solutions.

About 10,000 tons of tailings have been treated at these works, from which £18,000 worth of gold has been obtained. The tailings have yielded, on an average, about 36s. per ton. There are still about 4,000 tons of tailings at the works, which it is expected will yield from 12 to 14 dwts. per ton.

The value of the tailings have decreased considerably of late, owing to the richer ore being treated by chlorination, and they do not now contain more than 6 to 8 dwts. per ton, while formerly large quantities contained as much as 2 oz. per ton.

The capacity of the works is about 150 tons per week.

PART V.

Other Auriferous Veins in the Vicinity of Wyalong.

All the reefs described in Part III occur within a tract of country about 120 chains square, and lie wholly within the area occupied by the granite.

Within the other geological area occupied partly by highly altered sedimentary rocks and partly by diorites passing into hornblende schist, auriferous reefs are not numerous, and only two have proved to be of any value within the area of the map accompanying this report. Of these, one is situated at Pine Ridge and the other on Pine Hill.

At Pine Ridge, which is situated about a mile and a half S. 20° E. of Wyalong Post Office, there is a band of altered sedimentary rocks, six chains in width, bounded on each side by diorite.

Close to the eastern side of this band is a quartz-reef, which dips to the east at an angle of about 80°. This reef has been worked for more than four years; but at the time of my visit only one claim was at work. I am unable to give the total yield from the Pine Ridge claims; but Mr. Leathley informed me that from his claim (M.T., 2) he had raised 101 tons of quartz, which yielded 111 oz. 11 dwts., or at the rate of 1 oz. 2 dwts. per ton. These figures do not include the contents of the blanketings and tailings, nor the return from the seventy tons of stone treated in the early days of the field, which was very unsatisfactory.

The reef averages about six inches in thickness; it widens out occasionally to about six feet, but where wide is usually of low value.

At Pine Hill, which is situated about one mile fifty chains S. 40° E. from Wyalong Post Office, there is a belt of sedimentary rocks about ten chains wide, bounded on each side by diorite. The reef there was not well defined; but rich patches of quartz, one yielding as high as 35 oz. to the ton, were obtained from it. I was unable to get the returns from the claims on this hill.

Called Back Reef.—This line of reef is situated within an extension of the Wyalong granite, and is distant about three miles N.N.E. of Wyalong Post

Office. It was discovered nearly four years ago by Messrs. Hodge and Hunter, when on their return journey from the Nine-mile rush, and a short time after the discovery at Wyalong.

Gold-bearing quartz was found on the crown of the hill, near the southern end of the line. The strike of the main reef is N.E. and S.W., and its dip is slightly to the S.E.; but in places the reef is practically vertical.

A second reef lies about fifty feet to the east of the first; but little work has been done on it to prove whether it is of any value. The main reef has been traced for a distance of 1,200 feet, and at intervals along its course shafts have been put down on it, the deepest being 243 feet.

It is very remarkable that the country—rock, granite—is soft and decomposed even at that depth.

Water seems to be present in rather large quantity, and has retarded the development of this reef.

Some very good stone was taken from this reef in 1896, since when very little work has been done on it.

I am indebted to Mr. James Allen for the following information concerning the mines on the line of reef:—

Commencing on the north, the mines on this reef are the 9-acre Lease, Balaclava (G.L. 766), Lady Mary (formerly known as the North British Co. G.L. 769), Called Back United (G.L. 780), and No. 1 South. The reef has been worked principally in the Lady Mary and Called Back United Mines.

In the former the reef averages about two feet six inches in width, and the deepest shaft is 243 feet. About 160 tons of stone have been raised from the stopes between 125 and 170-foot levels, and have yielded 190 oz., or 1 oz. 4 dwts. per ton. The value of the stone ranged from 6 oz. to 6 dwts. per ton.

In the Called Back United Mine the reef varied in width from one inch to four feet, and averaged about two feet six inches. Fifty tons of stone, taken from some shallow shafts, yielded 10 dwt. per ton; and 215 tons from the stopes between 125 and 180-foot levels yielded 270 oz., or an average of 1 oz. 5 dwts. per ton.

From the Balaclava Mine only 48 tons of stone have been raised, yielding 50 oz., or 1 oz. 1 dwt. per ton.

No stone has yet been raised from the 9-acre Lease and No. 1 South.

Hiawatha.

While engaged on the geological examination of the Wyalong Gold-fields I paid several visits to Hiawatha, where prospecting operations were being vigorously carried on owing to the discovery of gold there in the early part of 1898. The site of the mining operations is about eight miles N.N.W. of Wyalong Township, on Portions 10 and 12, and the adjoining Crown lands of the Parish of Hiawatha, County Gipps.

Gold was first discovered on portion 12 by Messrs Conway and Ryan, and traced by them into the adjoining Crown lands. The discovery was made on Good Friday and reported on the following Monday.

All the reefs found at Hiawatha are in granite, which rock seems to occupy a large portion of the surrounding country, and would seem to be continuous with the Wyalong mass. All the reefs already found strike approximately E. and W., and dip to the north, and in these features differ from the Wyalong reefs, which have a general N. and S. trend.

The reefs are, on the whole, small and occasionally rich, but the gold contained in them is decidedly patchy in its distribution. In some cases, as at Molloy's Claim on Portion 10, rich prospects were obtained at the surface.

The best yield obtained from any of the Hiawatha reefs came from Crawley and Party's Claim on portion 10, and was 38 oz. 13 dwts. of gold from 9 tons of stone, or at the rate of 4 oz. 6 dwts. per ton. From other reefs yields as low as 3 or 4 dwts. per ton have been obtained. On the Prospector's Claim on Crown lands, a shaft 87 feet in depth has been sunk, and some driving has been done on a band of crushed rock, in which are occasionally large masses of quartz. The returns from this mine have been 8 tons for 11 oz. 17 dwts., or nearly 1½ oz. per ton, 2 tons treated by chlorination for 2 oz. per ton, 64 tons for 10 dwts. per ton, and 12 tons for 6½ dwts. per ton.

To the east of the Prospector's is Crampton's Claim (No. 1 East). The deepest shaft on this is 173 feet, vertical for 110 feet, and on the underlay for the remainder of the distance. The reef varies in size from 2 to 18 inches in thickness, averaging about 9 inches. The returns from this mine are 5 tons for 2 oz. per ton, and 16 tons for 5 dwts. per ton.

To the east of Crampton's Claim are two others known as "Early Morn," and "Nelson's." Ten tons of stone from the former yielded only 3 dwts. per ton, and 20 tons from the latter gave a similar yield.

Less than a quarter of a mile west of the Prospector's Claim, and on portion 12, is the "Blow." This is a large mass of quartz, which strikes east and west, and dips to the north. It has been sunk on to a depth of 60 feet, and 10 tons from it are said to have yielded 9½ dwts. to the ton, and another 10 tons 8½ dwts. per ton.

On Portion 10 Mr. D. Molloy, who holds an area of 5 acres, is the original finder of the gold. The reef in this ground varies in thickness from an inch or less to twenty inches, and dips at an angle of about 60° to the north. In the west end of the drive, at the 55-foot level, is a large white reef of poor quality, and much stained by black oxide of manganese. A little galena and iron pyrites are present in the reef. The returns from this mine have been 9 tons for 1 oz. 14 dwts. per ton, and 43 tons for 18½ dwts. per ton.

The reef in the claim adjoining the above on the west is small, and no stone has been raised from it, but specimens showing gold freely have recently been found.

In the claim to the east of Molloy's much sinking and driving was done, but nothing of any value was found.

A quarter of a mile E.N.E. of Molloy's Claim is Crowley's Claim. There two reefs were found, one about seven inches in thickness, on the footwall, consisting of hard white quartz, and containing very little gold; the other, on the hanging wall, about six inches in thickness, consisting of sandy quartz, is fairly rich. The reefs strike E. and W., and dip at about 80° to the north. The returns from this claim are—10 tons for 1 oz. per ton, and 9 tons for 4 oz. 6 dwts. per ton.

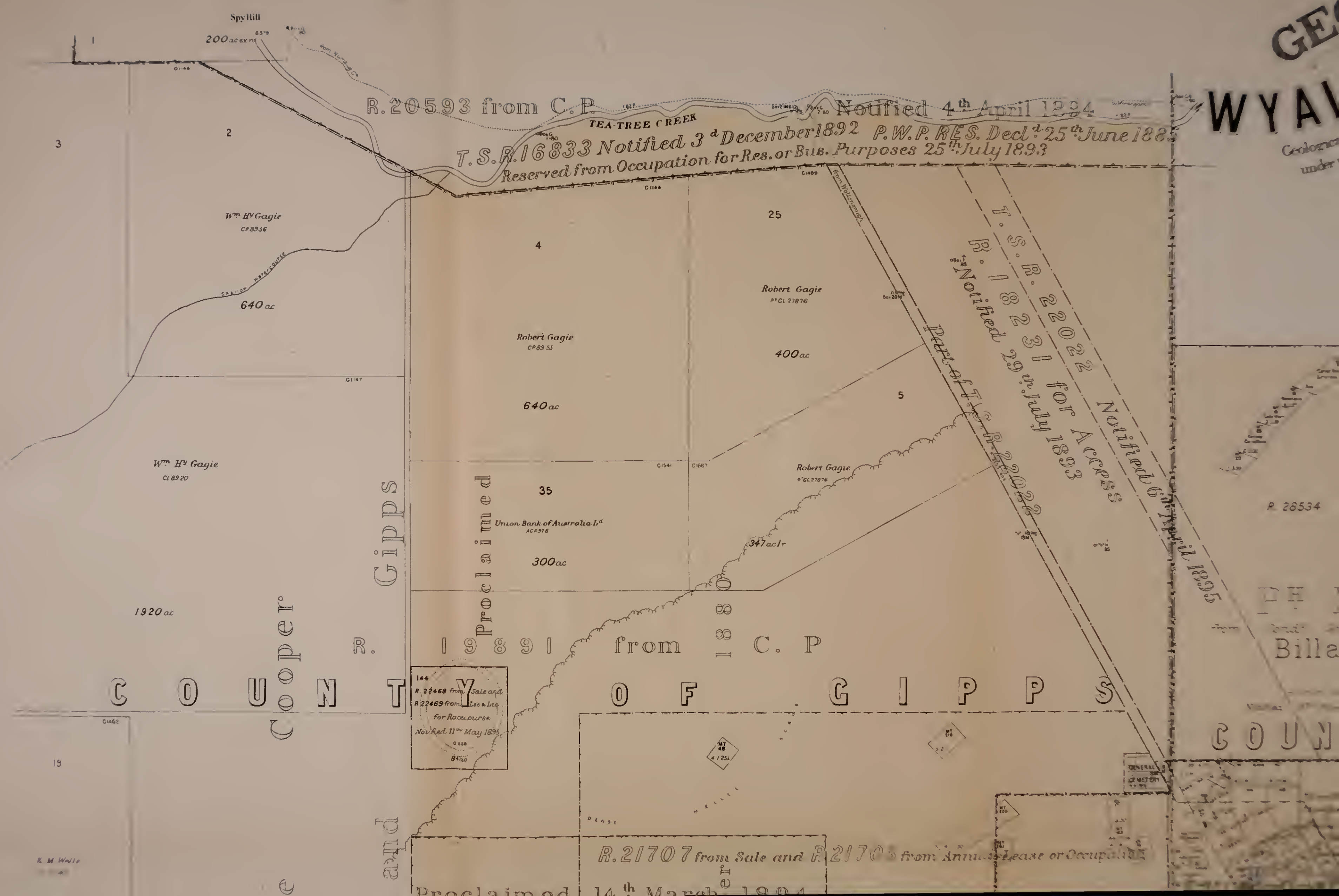
The other claims in this neighbourhood are Wilcoxson's and Ryan's. From the former 10 tons have been raised, and treated for a return of 16 dwts. per ton. A peculiar feature of this reef is the occurrence in it of a pale green opal. From Ryan's Claim 8 tons were treated for a return of 4 dwts. per ton.

Two other claims were being worked at the time of my visit; these are situated west of Crowley's, and near the road. On Fletcher's a shaft has been sunk to a depth of 124 feet, and a crosscut 18 feet long intersected the reef, which is about eight inches thick.

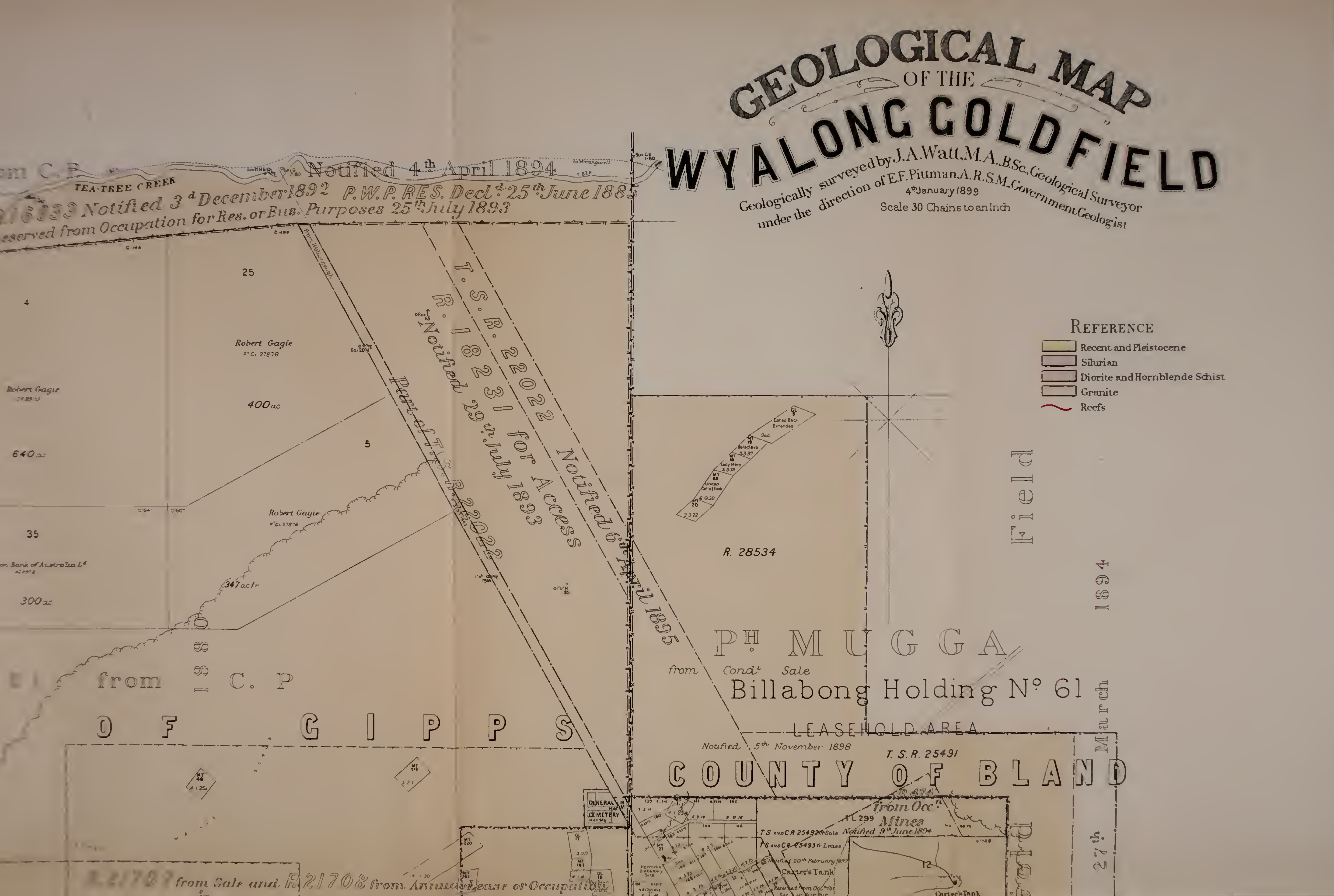
Sixteen and a half tons have been treated for a yield of 1 oz. 3 dwts. per ton. No stone has been raised from Dawson's Claim, where a reef six inches wide occurs.

[Map.]

Sydney: William Applegate Gullick, Government Printer.—1899.



Spy Hill
200 acres
R. 20593 from C. P.
Notified 4th April 1894
TEA-TREE CREEK
T. S. R. 16833 Notified 3d December 1892
P. W. P. RES. Decld 25th June 1885
Reserved from Occupation for Res. or Bus. Purposes 25th July 1893
WYA
3
2
Wm Hy Gagie
CP 8936
640 ac
4
25
Robert Gagie
CP 8955
640 ac
Robert Gagie
P CL 27876
400 ac
5
T. S. R. 22022 Notified 6th April 1895
R. 18231 for Access
Notified 29th July 1893
Part of T. S. R. 22022
Wm Hy Gagie
CL 8920
1920 ac
35
Union Bank of Australia Ld
ACP 978
300 ac
Robert Gagie
P CL 27876
347 ac 1r
R. 26534
Proclaimed
R. 1891 from 1880 C. P
Cooper
Gipps
144
R. 22468 from Sale and
R 22469 from Lse & Lic
for Racecourse
Notified 11th May 1895
84 ac
COUNTY OF GIPPS
COUN
19
Billa
GENERAL CEMETERY
R. 21707 from Sale and R. 21708 from Annual Lease or Occupation
Proclaimed 14th March 1894


GEOLOGICAL MAP
OF THE
WYALONG GOLDFIELD
Geologically surveyed by J.A.Watt, M.A., B.Sc., Geological Surveyor
under the direction of E.F.Pittman, A.R.S.M., Government Geologist
4th January 1899
Scale 30 Chains to an Inch
REFERENCE
Recent and Pleistocene
Silurian
Diorite and Hornblende Schist
Granite
Reefs
TEA-TREE CREEK
Notified 4th April 1894
Notified 3d December 1892
P.W.P. RES. Decd. 25th June 1885
Reserved from Occupation for Res. or Bus. Purposes 25th July 1893
T. S. R. 22022 Notified 6th April 1895
R. 18231 for Access
Notified 29th July 1893
Part of T. S. R. 22022
Robert Gagie
400ac
640ac
300ac
347ac 1r
R. 28534
Ph. MUGGA
from Condl. Sale
Billabong Holding No. 61
LEASEHOLD AREA
Notified 5th November 1898
T. S. R. 25491
COUNTY OF BLAND
OF GIPPS
from C. P
GENERAL CEMETERY
from Occn. Mines
Notified 9th June 1894
Carter's Tank
from Sale and R. 21708 from Annual Lease or Occupation
Field
1894
27th March

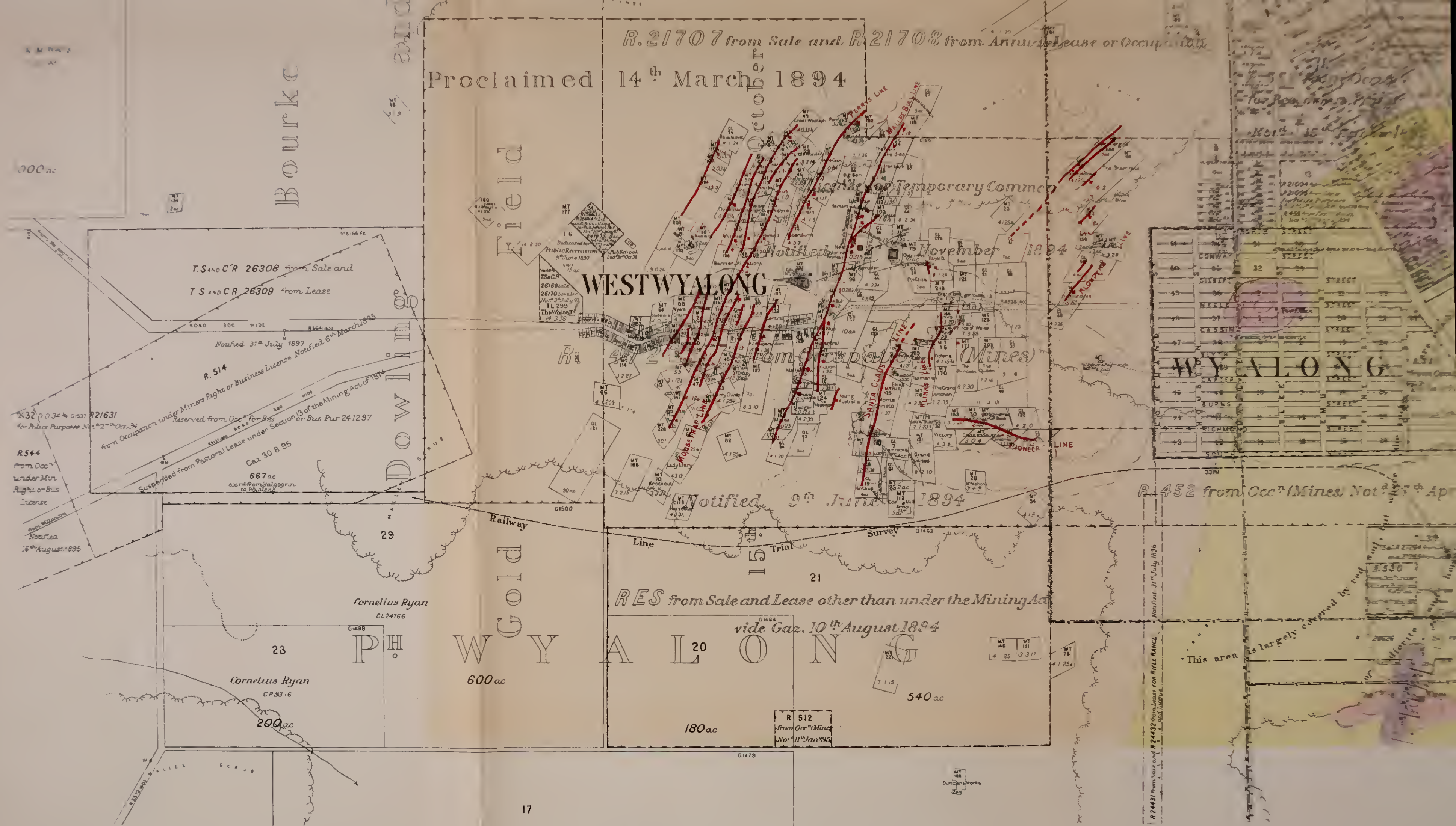
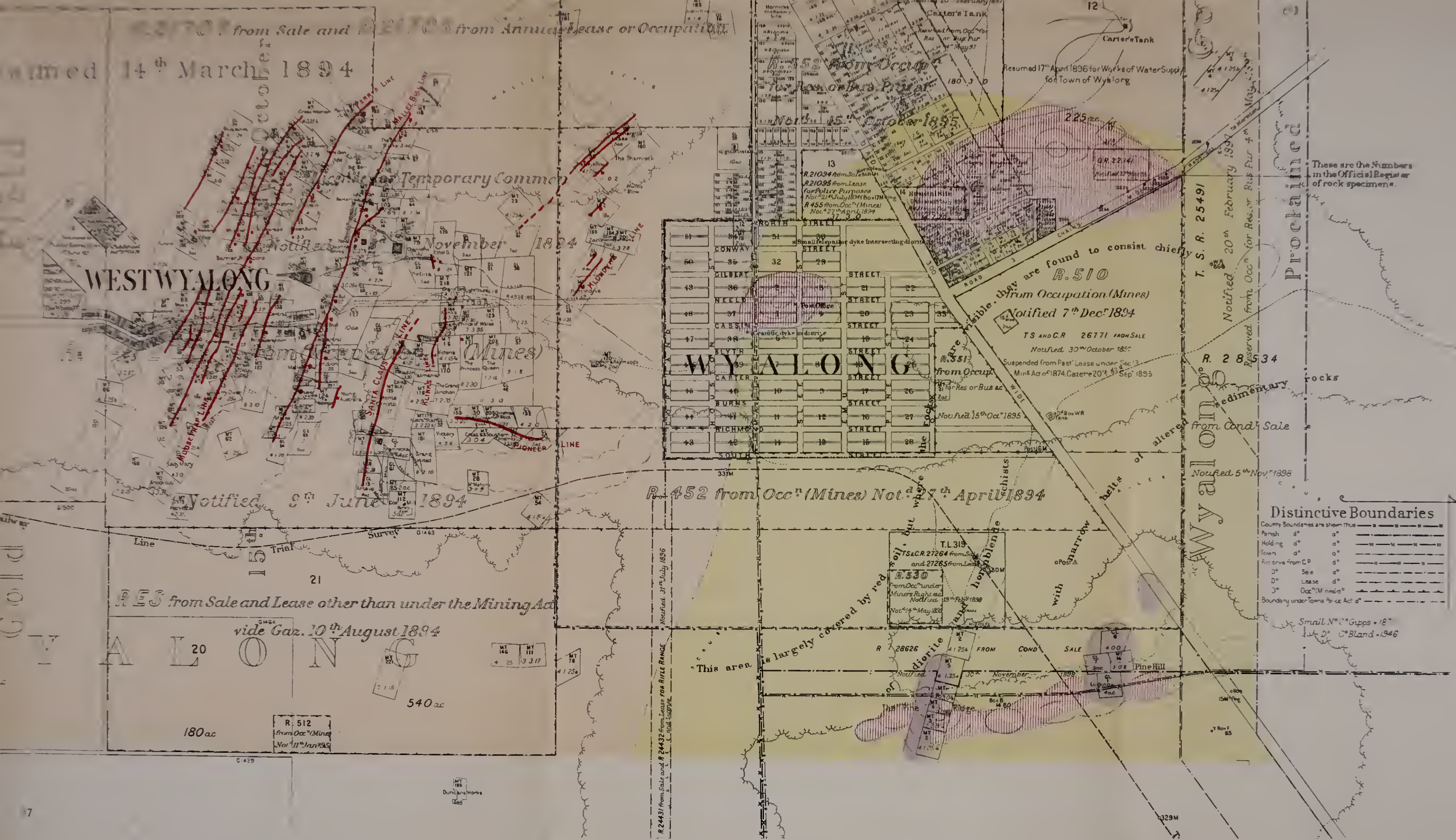


Photo-lithographed by
W. A. Gullick, Government Printer,
Sydney, N.S.W.



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